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*Why Has Inequality in Weekly Earnings Increased in Canada?*

by René Morissette



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## ABSTRACT

Inequality in weekly earnings increased in the eighties in Canada. The growth in inequality occurred in conjunction with three facts. First, real hourly wages of young workers dropped more than 10%. Second, the percentage of employees working 35-40 hours per week in their main job fell and the fraction of employees working 50 hours or more per week rose. Third, there was a growing tendency for highly paid workers to work long workweeks. We argue that any set of explanations of the increase in weekly earnings inequality must reconcile these three facts. Sectoral changes in the distribution of employment by industry and union status explain roughly 30% of the rise in inequality. The reduction in real minimum wages and the decline of average firm size explain very little of the growth in age-earnings differentials. Skill-biased technological change could have increased both the dispersion of hourly wages and the dispersion of weekly hours of work and thus, is consistent a priori with the movements observed. Yet other factors may have played an equally important - if not more important - role. The growth in competitive pressures, possible shifts in the bargaining power (between firms and labour) towards firms, the greater locational mobility of firms, the increase in Canada's openness to international trade, the rise in fixed costs of labour and possibly in training costs may be major factors behind the growth in weekly earnings inequality in Canada.

Key words : Hours worked; Inequality; Workweek; Wages.



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## I. Introduction

Most of the explanations which have been put forward so far to explain the growth in inequality in annual earnings in the United States center around the growing dispersion of either weekly wages (e.g. Katz and Murphy 1992), hourly wages (e.g. Bound and Johnson 1992; Murphy and Welch 1992) or both (e.g. Juhn, Murphy and Pierce 1993). Little attention has been paid to the potential influence of changes in the distribution of hours of work. In a recent study, Morissette, Myles and Picot (1994) (henceforth MMP) show that the increase in earnings inequality in Canada occurred in conjunction with changes in the distribution of **annual** hours worked. They also highlight two related facts. First, the changes in the distribution of annual hours coincided with changes in the distribution of **weekly** hours worked. Over the last decade, the proportion of individuals working 35 to 40 hours per week in their main job has fallen while the proportion of employees working 50 hours per week or more has increased. Second, the correlation between hourly wage rates and annual hours worked rose in the eighties : there was a growing tendency for workers earning high wages to work longer hours and for lower-wage workers to work below-average hours. This tended to increase earnings inequality. The goal of this paper is to examine in detail these two facts.

Previous studies have examined changes in the distribution of **annual** hours. Picot, Myles and Wannell (1990) observed that both changes in hourly wage rates and in annual hours played an important role in the growing polarization of annual earnings. Macphail (1993) found that changes in inequality in annual hours worked were predominant in determining trends in earnings inequality during the eighties. Doiron and Barrett (1994) focused on the importance of annual hours worked and hourly wage rates in explaining differences in earnings inequality between men and women. They concluded that the larger female inequality in annual earnings was due to a greater inequality in the distribution of hours of work. They also found that changes in earnings inequality between 1981 and 1988 were generated mainly from movements in the hours distributions. Beach and Slotsve (1994), Burbidge et al. (1993), MMP (1994) and Wolfson (1992) have documented the increase in inequality in annual earnings observed in Canada over the last decade. Yet none of these studies has analyzed extensively changes in the distribution of hourly wages, **weekly** hours and weekly earnings in Canada during the 1980s. This paper fills this gap by doing so.

Using data from the 1981 Survey of Work History, the 1984 Survey of Union Membership and the 1986-90 Labour Market Activity Surveys, we show that 1) inequality in weekly wages has increased in the 1980s in Canada, 2) changes in the dispersion of weekly hours worked and growth in the correlation between weekly hours worked and hourly wage rates account for a substantial fraction of the rise in inequality in weekly earnings, 3) the relatively small increase in dispersion of hourly wages at the aggregate level masks substantial increases in wage differentials between age groups, moderate increases in wage differentials between education levels and a compression of hourly wages in unionized jobs, 4) the tendency of high-wage employees to work long workweeks has increased in all major industrial groups and in unionized as well non-unionized jobs.



Using data from the Labour Force Survey as well as from the aforementioned surveys, we document the growth in the dispersion of weekly hours of work. We show that the bulk of the growth occurred within groups of workers defined jointly by age and education. Mean weekly hours of highly educated workers have not increased relative to those of low-educated workers. Similarly, mean weekly hours of young workers have not fallen relative to those of their older counterparts during the last decade.

One explanation used to account for the growing dispersion of weekly hours worked is that increases in employers' fixed costs of labour may have induced firms to increase the use of part-time employment for low-skilled workers while simultaneously requiring longer workweeks from a group of "core", highly-skilled workers. If this is so, then hours dispersion should rise **within** establishments. Combining data from the Labour Force Survey and from the Survey of Employment, Payroll and Hours, we find some evidence consistent with this view. Specifically, we find that the growth in the variance of weekly hours across workers has resulted from an increase in hours dispersion within establishments as well as a growing dispersion of hours between establishments.

Recent U.S. studies on earnings inequality (e.g. Bound and Johnson, 1992; Katz and Murphy, 1992) have argued that skill-biased technological change is the major cause of the changes observed in the structure of wages. The polarization of weekly hours of work, which is observed **both** in Canada and in the United States, suggests that other factors, such as the growth in competition, possible shifts in the bargaining power (between firms and labour) towards firms, the greater openness of the Canadian economy to international trade, increases in fixed costs of labour resulting from higher payroll taxes, and possible increases in training costs may have played an equally important - if not more important role in Canada.

The paper is organized as follows. First, we define the data sources and concepts used in this paper (section II). Next, we show that the growth in the dispersion of weekly hours of work and in the correlation between hourly wage rates and weekly hours account for most of the increase in weekly earnings inequality in Canada (section III). Changes in the distribution of hourly wages, the growth in the dispersion of weekly hours of work and the increase in the correlation between hourly wages and weekly hours are documented in section IV and V and VI, respectively. Section VII reviews the possible factors behind the rise in weekly earnings inequality in Canada. Concluding comments follow in section VIII.

## II. Data and Concepts

In this paper we examine the role of weekly hours of work and hourly wage rates in explaining the rise of inequality in **weekly** earnings in Canada over the last decade. The 1981 Survey of Work History (SWH), the 1984 Survey of Union Membership (SUM) and the 1986-1990 Labour Market Activity Surveys (LMAS) include data on both weekly hours and hourly wage rates and thus can be used to address this issue. The Labour Force



Survey (LFS) does not include hourly wage rates but contains data on weekly hours worked. It can be used to examine trends in the distribution of weekly hours over the period 1976-1994 and to assess whether these trends conform to those found for the period 1981-1990 using SWH-SUM-LMAS.

Ideally, we would like to restrict our attention to individuals who are already in the labour market, i.e. who previously made a transition from school to work. Contrary to LFS, SWH does not distinguish individuals who are full-time students from other individuals. Since SUM is restricted to individuals who are paid workers in the main job they held in **December** 1984, we must select individuals who are paid workers in the main job they held during that specific month. Furthermore, weekly hours worked are topcoded at 99 in SUM. Because of these three restrictions, the sample selected whenever we use SWH-SUM-LMAS consists of paid workers aged 17 to 64, who were working 98 hours or less per week in the main job they held in December<sup>1</sup>. In contrast, whenever we use LFS, the sample consists of individuals aged 15 to 64, who are not full-time students and who were working 98 hours or less in the main job they held in September. Weekly earnings, weekly hours worked and hourly wage rates are those associated with the main job. The main job is the one with the greatest number of hours usually worked per week. As is usual in LFS, part-time jobs are defined as those involving 29 hours or less per week and full-time jobs as those requiring at least 30 hours per week<sup>2</sup>.

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<sup>1</sup> We use the SWH-SUM-LMAS cross-sectional **master** files. To exclude some records with extremely high hourly wage rates, we further restrict the sample to individuals earning no more than \$ 300 per hour (in constant dollars of 1989). All calculations in this paper are based on survey weights.

<sup>2</sup> Since SWH, SUM and LMAS have different questionnaires, one may ask whether the data resulting from these various surveys is consistent over time. All these surveys are based on the survey design and sampling frame of the Labour Force Survey. While the questions used in SWH and SUM to collect data on weekly hours refer to the number of **hours usually worked**, those used in LMAS refer to the number of **paid hours usually worked**. One of the important findings of the study is that the dispersion of weekly hours worked has increased through the eighties. One could argue that this result is simply due to the conceptual difference noted above. This is not the case. Using the Labour Force Survey - which provides a consistent time series of weekly **hours usually worked** over the period 1976-1994 - we confirm this finding.

Hourly wage rates are calculated by dividing the usual wage or salary workers report (on a hourly, daily, weekly, monthly or annual basis) by the number of hours worked during the relevant time interval. Two points are worth noting. First, the set of categories used to collect the amounts reported differ slightly over time. While all surveys contain the four categories "per hour", "per week", "per month" and "per year", some include "bi-weekly" wages (SUM and LMAS) while others include "total earnings from this employer during the reference year" (SWH). Since the four categories defined above account for 90% or more of all observations in SWH, SUM and LMAS 1986, this should not pose a problem. Second for each of these four categories, the formulas used to calculate hourly wage rates are **identical** for both SWH and LMAS. The only difference is - as noted above - that SWH measures hours usually worked while LMAS measures **paid** hours usually worked. Since most of our findings are based on these two surveys, it is reasonable to think that these findings reflect actual changes taking place in the labour market rather than data consistency problems.



### III. Inequality in Weekly Earnings : 1981-1990

The gap between low and high wage earners widened during the eighties (Figure 1). While average real weekly earnings among men at the bottom quintile fell 4% between 1981 and 1988 - two years in which the unemployment rate averaged 7.5% and 7.8%, respectively - they rose 5% among men at the middle quintile and 9% among those at the top quintile<sup>3</sup>. Among women, the gap rose less : average real weekly earnings at the bottom, middle and top quintile changed by -1%, 3% and 7% respectively during that period.

The widening of the gap (as measured by average real weekly wages) between the top quintile and the bottom quintile is associated with diverging growth in both weekly hours worked and hourly wage rates. Between 1981 and 1988, weekly hours worked by men in the top quintile rose 5.6% while those worked by men in the bottom quintile fell 5.8% (Table 1). Moreover, while real hourly wages of men in the bottom quintile remained virtually unchanged, those received by men in the top quintile increased by 3.9%. Similar results are obtained for women; both real hourly wages and weekly hours worked grew faster among women in the top quintile than among those in the bottom quintile. For both men and women, weekly hours worked have increased more - both in absolute and in relative terms - among workers with high weekly wages than among their low-paid counterparts.

The first panel of Table 2 presents trends in the variance of log weekly earnings, log weekly hours, log hourly wages and in the covariance term<sup>4</sup>. Between 1981 and 1988, the variance of log weekly earnings increased by 16% and 9% for men and women respectively<sup>5</sup>. In contrast, the variance of log hourly wages, while sensitive to cyclical

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<sup>3</sup> Most of the comparisons made in this paper for the 1980s are based on the years 1981 and 1988. Two reasons justify that. First, the labour market conditions are roughly comparable for these two years. Second, changes in the coding of education levels do not allow comparisons after 1988. Specifically, the only comparison that can be made after 1988 is between the "0-10 years of schooling" category and the "11-13 years of schooling" category (Gower 1993).

<sup>4</sup> The variance of logs can be used to assess the contribution of weekly hours and hourly wage rates in explaining changes in inequality in weekly earnings. If  $e$ ,  $h$  and  $w$  are log weekly earnings, log weekly hours and log hourly wages respectively, then  $\text{Var}(e) = \text{Var}(h) + \text{Var}(w) + 2\text{Cov}(h,w)$ .

<sup>5</sup> As is well known (e.g. Cowell (1977, 31)), the variance of logs will increase whenever a rich person transfers money to a poorer person whose income exceeds 2.72 times the mean income of the population. Thus, it may increase even though the Lorenz curve of weekly earnings of 1988 does not lie below that of 1981. The only way to ensure that the Lorenz curve of weekly earnings of 1988 lies below that of 1981 is to compare the Lorenz curve ordinates for both years (or alternatively, to plot the two Lorenz curves). For both men and women, the Lorenz curve ordinates for weekly earnings of 1988 are, for each centile, lower than those of 1981. The same comparison can be done for weekly hours worked and hourly wage rates. Among men, the Lorenz curve ordinates for weekly hours worked in 1988 are, for all centiles except the second centile, lower than those of 1981. The Lorenz curve ordinates for hourly wage rates of 1988 are, for all centiles except the 1st to 6th and the 91st to 99th, lower than those of 1981. Among women, the ordinates for weekly hours worked in 1988 are, for all centiles except the 3rd, 4th, 15th, 18th, 19th, 21st, 22nd, 24th and 99th centile, smaller than those of 1981. The ordinates for hourly wage rates of 1988 are, for all centiles except the 15th to 49th centile, lower than those of 1981.



conditions, shows little change between these two years. In 1988, it was only 2% higher than in 1981 among men and 3% lower among women. Most important, for both sexes, the covariance between log weekly hours worked and log hourly wages more than doubled between 1981 and 1984, i.e. right after the 1981-82 recession. It then remained at relatively high levels through the eighties.

The second panel of Table 2 assesses how much of that increase in inequality in weekly earnings is accounted for by: 1) changes in dispersion of weekly hours worked, 2) changes in dispersion of hourly wage rates and 3) changes in the correlation between these last two variables. Three points are worth noting. First, changes in the dispersion of hourly wage rates explain at most 32% of the growth in dispersion of weekly wages in Canada, depending on the time interval selected. Second, changes in the dispersion of weekly hours worked play - as pointed out by MMP (1994) - an important role in Canada for males. They account for 12%-37% of the rise in inequality in weekly wages. Third, the increase in the correlation between weekly hours worked and hourly wage rates is, for both men and women, the dominant factor. It accounts for at least half of the increase in inequality.

#### **IV. The Dispersion of Hourly Wage Rates**

The small changes in the dispersion of hourly wages registered at the aggregate level suggest that little action has taken place in the distribution of hourly wages during the eighties. This is misleading. While real hourly wages of males aged 35 or more rose by at least 5% between 1981 and 1988, those of workers aged 17 to 24 fell by more than 15% for men and more than 10% for women (Figure 2). The decline of youth relative wages is widespread; it is observed for all education levels, in all major industrial and occupational groups (Betcherman and Morissette, 1994)<sup>6</sup>.

This increase in hourly wage differentials between age groups is consistent with the rise in weekly/annual wage differences across age groups found in previous studies using data from the Survey of Consumer Finances (e.g. Beach and Slotsve, 1994 and MMP 1994). A more contentious issue is whether wage differentials between education levels have increased. Freeman and Needels (1991) find that the wage gap between university and high school graduates rose during the eighties, but not as much as in the United States. Focusing also on university and high school graduates, Bar-Or et al. (1993, 1) find that "while there appears to have been a decline in the returns to education in the 1970's [...], the return to a university degree did not rebound much during the 1980's ...". Beach and Slotsve (1994) consider all education levels and find that education differentials rose for men employed full-time full year, especially among university graduates.

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<sup>6</sup> Furthermore, Betcherman and Morissette (1994) find that the decline of youth relative wages persists after regressing the natural logarithm of hourly wages on marital status, education levels, major industrial groups, major occupational groups, union status and province of residence.

All three studies, which use data from the Survey of Consumer Finances, measure either annual wages of full year full-time workers (Bar-Or et al. 1993; Beach and Slotsve 1994) or both annual and weekly wages of all earners (Freeman and Needels 1991)<sup>7</sup>. Ideally, the issue of whether pay rates have diverged across education levels over the last decade should be addressed using data on hourly wage rates. Secondly, none of these studies controls for workers' differences in industry affiliation or union status<sup>8</sup>. As is well known, hourly wage rates differ widely across industries (Krueger and Summers 1988) and between unionized and non unionized jobs (Freeman 1984). Thirdly, both Freeman and Needels (1991) and Bar-Or et al. (1993) restrict their attention to university and high school graduates, potentially neglecting changes in the education premium for other education levels.

To deal with these three issues, we estimate a hourly wage equation with the following vector of regressors : 1) one dummy for marital status, 2) four age dummies, 3) four education dummies, 4) sixteen interaction terms between age and education level, 5) 7 industry dummies, 6) one dummy for union status, 7) one dummy for full-time/part-time jobs and 8) four region dummies<sup>9</sup>. This flexible specification allows us to look at the education differentials both within age groups and within industries. It also takes account of the impact of unions in wage setting. We run these regressions for 1981 and 1988.

The results of these regressions are presented in Table 3. The ratio of hourly wages of **university graduates** to those of individuals with **9-13 years of schooling** has either increased or shown little change among workers - both men and women - aged 25 or more. It has risen by more than 10 percentage points among men aged 35-44 and 55-64<sup>10</sup>

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<sup>7</sup> More precisely, the sample used by Freeman and Needels (1991) consists of **heads of household and spouses**.

<sup>8</sup> Obviously, this will affect how coefficients will change through time only if the distribution of employment by industry or union status changes. This was the case between 1981 and 1988. First, the relative importance of services-producing industries rose. Second, while the unionization rate remained fairly constant in the aggregate, it fell substantially for young workers.

<sup>9</sup> The age variable is defined in discrete terms in SWH and thus cannot be used as a continuous variable in the regressions. The age groups are the following : 17-24, 25-34, 35-44, 45-54 and 55-64. The education levels are the following : 1) none or elementary, 2) 9-13 years, 3) some post-secondary, 4) post-secondary certificate or diploma and 5) university degree. The major industrial groups are : 1) agriculture, fishing and trapping, 2) forestry and mining, 3) construction, 4) manufacturing, 5) distributive services, 6) business services, 7) consumer services and 8) public services. The categories "not married", "aged 17 to 24", "9-13 years of schooling", "Consumer Services", "Not unionized", "Part-time" and "Ontario" are the reference groups. Regressors also include a constant term. The dependent variable is the natural logarithm of hourly wages. When we run these regressions, some interaction terms are not statistically significant at the 5% level. Thus, the wage equations are re-estimated using only the statistically significant interaction terms. The numbers presented in Table 3 are based on this last set of regressions.

<sup>10</sup> The percentage wage differential between workers with a given education level and those with 9-13 years of schooling equals the antilog of the coefficients presented in Table 4 minus 1 and expressed as a percentage. For instance, male university graduates aged 35 to 44 earned 31% higher wages than those with 9-13 years of



but has remained unchanged among men under 35 and has displayed little variation among those aged 45-54. It has also increased by more than 10 percentage points among women aged 35 or more. Changes in the education premium occurred in other education levels as well. Among workers aged 25 or more, hourly wages of individuals with elementary schooling either fell or showed little change relative to those of individuals with 9-13 years of schooling. As a result, the ratio of hourly wages of **university graduates** to those of individuals with **elementary schooling** has widened by at least 10 percentage points among all workers except men aged 45-54 and individuals aged 17-24. Hence, at least for workers aged 25 or more, the evidence does suggest that wage differences between education levels have grown in the eighties.

Combined with the sharp increase in wage dispersion observed between age groups, this rise in wage differentials between education levels - among workers aged 25 or more - should have led to fairly substantial growth in hourly wage inequality. Yet, as was shown in Table 2, hourly wage dispersion showed relatively little variation between 1981 and 1988. Why has the increase in hourly wage inequality been so small at the aggregate level?

The answer is that hourly wage inequality **within** age groups has fallen over the 1981-88 period. To show that, we decompose the change in the variance of log hourly wages into three components : 1) the change in hourly wage dispersion between age groups, 2) changes in hourly wage dispersion within age groups and 3) the change in hourly wage dispersion resulting from changes in the age composition of the workforce (Table 4). To do so, we divide the population into two age groups: 1) workers aged 17-24 and 2) those aged 25-64 <sup>11</sup>. The increase in between-group wage dispersion between 1981 and 1988 amounts to roughly 50% of the increase in inequality in weekly wages for men. Yet the net contribution of hourly wages to this increase is - as Table 2 showed - much smaller than that. Similar results are observed for women. For both sexes, the variance of log hourly wages did not change much at the aggregate level during the eighties simply because increases in between-group inequality - due to the widening wage gap between young and older workers - were offset by decreases in hourly wage dispersion within age groups. Had this not been the case, changes in hourly wage inequality would have accounted for a much bigger fraction of the increase in inequality in weekly earnings than they actually do.

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schooling in 1981, where 31% equals  $\exp(0.27) - 1$ . Similar calculations for 1988 lead to a wage gap of 45%, i.e.  $\exp(0.37) - 1$ . Hence, the wage gap between male university graduates aged 35 to 44 and their counterparts with 9-13 years of schooling rose by 14 percentage points between 1981 and 1988.

<sup>11</sup> Define the two age groups by the index  $i=1,2$ . Then the variance of log hourly wages  $\text{Var}(w)$  can be written as follows:

$\text{Var}(w) = p_1 \cdot \text{Var}(w_1) + p_2 \cdot \text{Var}(w_2) + p_1 \cdot p_2 \cdot (m_1 - m_2)^2$ , where  $p_i$  is the proportion of age group  $i$  in the population,  $\text{Var}(w_i)$  is the variance of log hourly wages of age group  $i$  and  $m_i$  is the mean of log hourly wages of age group  $i$ . Since these terms do not enter linearly, the change in  $\text{Var}(w)$  can actually be decomposed into changes due to  $m_i$  (changes in between-group inequality), changes due to  $\text{Var}(w_i)$  (changes in within-group inequality), changes due to  $p_i$  (changes in the demographic weights) and changes in the interaction terms. In Table 4, we include changes in the interaction terms into changes in the weights.

Why then has hourly wage dispersion decreased within age groups? One explanation is that the distribution of hourly wages has become more compressed in the unionized sector. Between 1981 and 1988, real hourly wages of unionized men in the bottom quintile (of the **hourly wage** distribution of unionized men) rose 17%, compared to only 3% for those of male workers in the top quintile (Figure 3). Real hourly wages of unionized women in the bottom quintile grew 9% while those of their counterparts in the top quintile remained virtually unchanged. This suggests that in a context of low real wage increases which prevailed through the eighties, unions bargained to improve the relative position of their low-paid members.

For men and women, the decrease in hourly wage dispersion in the unionized sector is observed both for workers aged 17-24 and for those aged 25-64; the variance of log hourly wages fell between 15% and 30%, depending on the group selected (Panel I, Table 5). Yet, among workers aged 17-24, the distribution of hourly wages became more compressed in the non-unionized sector as well<sup>12</sup>. Thus, the compression of hourly wages in unionized jobs is not the only factor behind the decrease in hourly wage dispersion among young employees<sup>13</sup>.

A second possibility is that changes in the way individuals report their earnings may have played a role. Specifically, more workers reported their earnings on an hourly basis in the 1988 Labour Market Activity Survey than in the 1981 Survey of Work History (Table 6). If individuals who report their earnings on an hourly basis give more accurate answers than the others, this could tend to decrease the variance of reported earnings and thus the variance of hourly wage rates in 1988, compared to 1981<sup>14 15</sup>.

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<sup>12</sup> Among workers aged 25-64, the variance of log hourly wages shows very little change for non-unionized workers. It increases by 1% for men and falls by 3% for women.

<sup>13</sup> To assess the extent to which the compression of hourly wages in the unionized sector reduced hourly wage dispersion within age groups, we recalculated the hypothetical variance of log hourly wages which would have prevailed in 1988 if **only** the variance of log hourly wages in unionized jobs had changed (i.e. holding constant both demographic weights and union wage differentials). We then computed the hypothetical drop in the variance of log hourly wages which would have been observed within age groups and compared it with the actual drop. When this is done, the compression of hourly wages in unionized jobs accounts for 13% and 8% of the compression of hourly wages among young men and young women, respectively. However, it accounts for 69% of the compression of hourly wages among older women and explains the whole decline in hourly wage dispersion among older men.

<sup>14</sup> We assume implicitly either : 1) that the covariance between the true earnings and the error term is not negative or 2) if the covariance is negative, that it does not offset completely the variance of the error term.

<sup>15</sup> We also looked at trends in within-group inequality in a formal way. For 1981, 1984, 1986, 1987 and 1988, we regressed the natural logarithm of hourly wages on the following vector of explanatory variables : 1) one dummy for marital status, 2) four age dummies, 3) four education dummies, 4) sixteen interaction terms between age and education, 5) seven industry dummies, 6) one dummy for union status, 7) one dummy for full-time/part-time job and 8) four region dummies. Following Juhn, Murphy and Pierce (1993), we then computed the standard deviation of the residuals as well as the differences between percentiles of the residual distribution. The results of



To check this possibility, we use data from the Survey of Consumer Finances of 1981 and 1988. We assume that weekly hours worked in the week of the survey (i.e. April 1982 and April 1989, respectively) are equal to usual hours per week in the reference year (i.e. 1981 and 1988). This allows us to derive measures of weekly earnings, hourly wages and weekly hours of work for these two years<sup>16</sup>. We then examine the variance of log hourly wages within age groups. Table 7 presents the results of this exercise. Contrary to SWH 1981 and LMAS 1988, the numbers from SCF show an **increase** in hourly wage dispersion within age groups. This is in line with the evidence found in the United States with the Current Population Survey (e.g. Katz and Murphy 1992)<sup>17</sup>. This is also consistent with the idea that the decrease in hourly wage dispersion within age groups found in the first panel of Table 5 may be due partly to the increase in the fraction of workers reporting earnings on an hourly basis.

If this were the case, what would be the implications for our results? First, the dispersion of hourly wages and weekly earnings may have increased more in the eighties than SWH and LMAS suggest. As a result, the contribution of hourly wages to the growing dispersion of weekly earnings may be higher than that found in Table 2<sup>18</sup>. Second, as long

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this exercise are presented in Appendix 1 (Table A1) and show that within-group inequality fell between 1981 and 1984 and then remained fairly constant. This is consistent with the idea that the decrease in within-group inequality between 1981 and 1988 may be partly due to the increase in the fraction of individuals reporting their earnings on an hourly basis between these two years.

<sup>16</sup> Kuhn and Robb (1994, 6) argue that "due to reporting error in either annual earnings or weeks worked, the wage measure resulting from this calculation systematically and significantly overestimates the average wage rates of individuals with low weeks worked, resulting in a disproportionate number of these workers being misclassified into the top two deciles of the wage distribution." Specifically, the average number of weeks worked during the reference year appear abnormally low for workers in the top decile. To take this into account, we exclude the top 10% of the hourly wage distribution. The results of Table 7 are based on the remaining sample. While the calculation outlined above is surely biased, it is not clear that the bias changes over time. Thus, the procedure is potentially valid for estimating changes in inequality over time, if not levels.

<sup>17</sup> This is also consistent with the growth in within-group inequality found by Morissette, Myles and Picot (1993, 10). Using SCF data, they showed that, between 1981 and 1988, more than half of the growth in inequality in annual earnings observed among individuals working full year full-time occurred **within** groups defined jointly by age and education level.

<sup>18</sup> Let  $p_i$ ,  $h_i$  and  $w_i$  be log weekly earnings, log weekly hours and log hourly wages. Then :

$$w_i = p_i - h_i \quad (1)$$

$$\text{Var}(w) = \text{Var}(p) + \text{Var}(h) - 2\text{Cov}(p, h) \quad (2)$$

where  $\text{Var}(\ )$  and  $\text{Cov}(\ )$  denote the variance and the covariance of the relevant variables, respectively. Suppose that observed log weekly earnings  $p_i$  are measured with error and deviate from their true value  $p_i$  by a random term  $e_i \sim N(0, \sigma_e^2)$ , where  $e_i$  is independent of  $p_i$  and  $h_i$ . In other terms,  $p_i = p_i + e_i$ . Then equations (1) and (2) change as follows :

$$w_i = p_i - h_i + e_i \quad (3)$$

$$\text{Var}(w) = \text{Var}(p) + \text{Var}(h) - 2\text{Cov}(p, h) + \sigma_e^2 = \text{Var}(w) + \sigma_e^2 \quad (4)$$

as reporting errors are uncorrelated with workers' characteristics, mean hourly wages and mean weekly earnings of various demographic groups will remain unbiased. Thus, trends in between-group inequality (in hourly wages or weekly earnings) should not be affected. Third, the growth in the dispersion of weekly hours, documented in Table 2, is - as will be shown below - also observed with data from the Labour Force Survey. Since LFS provides a consistent time series on weekly hours between 1976 and 1994, the increase in hours dispersion cannot be attributed to consistency problems between SWH and LMAS.

A less trivial issue is whether the increase in the correlation between log weekly hours and log hourly wages found in Table 2 merely results from a decrease in the measurement error associated with hourly wages. Standard statistical results imply that an increase in the accuracy of reported earnings between 1981 and 1988 would increase the absolute value of the correlation coefficient between log weekly hours and log hourly wages. Put simply, the greater tendency of highly paid workers to work longer workweeks could simply be due to the growth in the fraction of workers reporting their earnings on an hourly basis between 1981 and 1988. In Appendix 1, we deal with this issue. We present evidence from the Survey of Consumer Finances which shows that, since the second half of the eighties, highly paid workers have worked longer workweeks than they used to at the end of the seventies. We view this as strong evidence that the growing tendency of highly paid employees to work longer hours is real, rather than due simply to the changing fraction of workers reporting their earnings on an hourly basis.

Finally, we address the issue of whether the compression of hourly wages in unionized jobs simply results from the aforementioned changes between the Survey of Work History of 1981 and the Labour Market Activity Survey. To do so, we show the variance of log hourly wages for unionized workers who reported their earnings on an hourly basis (Panel II, Table 5). For men aged 25-64 and women aged 17-24, the dispersion of hourly wages decreases by at least 15% between 1981 and 1988. Once again, this suggests that the

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Equation (4) implies that both the variance of log hourly wages and the variance of log weekly earnings increase by the same amount, i.e.  $\sigma_e^2$ . Since the variance of log weekly hours  $\text{Var}(h)$  is not affected by the measurement error involving weekly earnings, it will remain constant. It follows that the covariance between log weekly hours and log **hourly wages**,  $\text{Cov}(w, h)$ , will also remain constant, i.e.  $\text{Cov}(h, w) = \text{Cov}(h, w')$ . Thus the contribution of hourly wages to the change in the variance of log weekly earnings will increase while the contribution of  $\text{Var}(h)$  and of  $\text{Cov}(h, w)$  will decrease. The Pearson correlation coefficient between log weekly hours and log hourly wages will change from :

$$r(h, w) = \text{Cov}(h, w) / \sqrt{\text{Var}(h) * \text{Var}(w)} \quad (5)$$

to :

$$r(h, w') = \text{Cov}(h, w') / \sqrt{\text{Var}(h) * \text{Var}(w')} \quad (6)$$

and will decrease since  $\text{Cov}(h, w) = \text{Cov}(h, w')$  and  $\text{Var}(w') > \text{Var}(w)$ . Thus, an increase in measurement error will decrease the absolute value of the correlation coefficient. This implies that a **decrease** in measurement error will increase the absolute value of the estimated coefficient. Thus, part of the increase in the correlation coefficient between log weekly hours and log hourly wages could be due to an increase in the accuracy of reported earnings, which in turn could be explained by the growth in the fraction of workers reporting earnings on an hourly basis between 1981 and 1988. Between 1981 and 1988, the Pearson correlation coefficient between log weekly hours and log hourly wages rose from 0.10 to 0.20 for men and from 0.03 to 0.13 for women.



compression of hourly wages in unionized jobs does not simply result from the reporting differences outlined above<sup>19</sup>.

## V. The Dispersion of Weekly Hours of Work<sup>20</sup>

### A) The Dispersion of Hours Across Workers

The changes in the dispersion of weekly hours worked are associated with a decline in the proportion of employees working 35-40 hours per week. Between 1981 and 1988, that proportion fell by 7 percentage points for men and 5 percentage points for women (Table 8). The decline of the standard workweek is not simply due to an increase in part-time employment. During that period, the percentage of men working 50 hours or more rose by roughly 3.5 percentage points. Smaller but persistent increases in that proportion are observed among women. In unionized jobs, the proportion of men working 35-40 hours per week has dropped 7 percentage points while the fraction of those working 50 hours or more has risen by 3 percentage points (Table 9). Thus, the changes in the distribution of weekly hours are not limited to non unionized jobs.

The Labour Force Survey confirms these trends. Between September 1976 and September 1994, the relative importance of the 35-40 hour workweek has been declining by roughly 10 percentage points for both men and women (Figure 4). As found with SWH-SUM-LMAS, this decline has been associated with an increase in both long and short workweeks. The increase in the relative importance of short workweeks has been accompanied by a significant increase in involuntary part-time employment among women and among young workers. Between 1976 and 1994, the fraction of female employees involuntarily employed part-time rose from 2% to 9% (Figure 5). Between these two years, involuntary part-time employment rose by 7 percentage points among young men and 11 percentage points among young women<sup>21</sup>.

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<sup>19</sup> One could still argue that part of the decrease in wage dispersion for unionized workers reporting earnings on an hourly basis reflects a compositional effect. In other words, the composition of the sample (in terms of age, education, industry, occupation, etc.) may differ between 1981 and 1988 due to the differences in reporting noted above. A stronger test of whether the decrease in wage dispersion reflects a true compression of hourly wages would be to compute the variance of logs within cells (e.g. within age/education groups). We have not attempted to do that. Thus the results of the second panel of Table 5 provide **some** evidence that the compression of hourly wages in unionized jobs is real.

<sup>20</sup> To analyze changes in the distribution of weekly hours worked, we rely mainly on the Labour Force Survey, which provides a consistent time series on weekly hours usually worked for the period 1976-1994. However, LFS contains no information on union status or on hourly wage rates while SWH-SUM-LMAS do include these two variables. For that reason, we use SWH-SUM-LMAS to look at : 1) changes in the distribution of weekly hours worked in unionized and non-unionized jobs (section V.A) and 2) changes in the number of hours worked by highly paid and low paid workers (section VI).

In a recent study, Morissette and Sunter (1994) have shown that the propensity of individuals to work 50 hours or more per week in their main job has increased in the 1980s in most major industrial groups. Furthermore, they have shown that the tendency to work 50 hours or more per week has risen among men employed in sales, among women employed in natural and social sciences, among individuals working in processing-related occupations as well as among managers.

The decline of the 35-40 hour workweek and the growth in the propensity to work 50 hours or more per week are not unique to Canada. Between 1979 and 1993, the percentage of male paid workers working 35-40 hours per week in the main job has dropped roughly 7 and 6 percentage points in Canada and in the United States, respectively (Figure 6). During that period, the fraction of male paid workers employed for 50 hours or more per week rose roughly 3.5 percentage points in both countries. In fact, the **changes** in the distribution of weekly hours of work observed in the United States almost replicate those observed in Canada.

The growing propensity to work long workweeks coincides with the increase in the number of hours of overtime. Figure 7 compares the average weekly hours of overtime worked by hourly-paid workers of the manufacturing sector - taken from the Survey of Employment, Payroll and Hours - to the deviation of real GDP from its trend. The period covered is 1983-1993. The results are striking. Both in 1983 and 1993, real GDP was roughly 4% below its trend value. Yet hourly-paid workers were working on average 2.2 hours of overtime per week in 1993, compared to only 1.6 hours in 1983. This suggests that firms in the manufacturing sector rely increasingly on hours of overtime as a means of expanding output.

In an economy relying increasingly on sophisticated production techniques and knowledge-based industries, one may expect an increase in demand for highly skilled workers. This could take the form of an increase in mean weekly hours worked by these employees. Thus, if skills are proxied by age and education, mean weekly hours of older highly educated workers could tend to rise. Table 10 shows that this is not the case. Among men aged 25 or more, the ratio of mean weekly hours of university graduates to those of high school graduates has remained virtually unchanged between 1981 and 1988. Furthermore, in all education levels, the ratio of mean weekly hours of men aged 45-54 to those of men aged 25-34 exhibits no growth.

Thus, at the aggregate level, there is no evidence that the dispersion of hours **between** age/education groups has increased. Changes in the composition of the workforce are unlikely to explain the growth in hours dispersion either. Since the dispersion of hours is generally higher among young than among old employees and since the share of young workers (i.e. those aged 17-24) in the workforce has fallen through the eighties, shifts in

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<sup>21</sup> Admittedly, a substantial fraction of this increase in involuntary part-time employment is driven by the 1990-92 recession.



the age distribution of the workforce should decrease inequality in weekly hours of work. The only explanation left is that the dispersion of hours increased **within** groups of workers of comparable age and education. Table 11 supports that contention. Virtually all the growth in either the Theil-Entropy index or the square of the coefficient of variation of weekly hours comes from an increase in hours dispersion within age/education groups<sup>22</sup>. As expected, changes in the composition of employment by age and education tended to reduce hours dispersion. Changes in hours dispersion between age/education groups have very little impact. The predominant role of the increase in within-group dispersion suggests that either skills uncorrelated with age and education and/or firms' characteristics are driving most of the growth in hours dispersion among men.

## **B) The Dispersion of Hours Between Establishments and Within Establishments**

The dispersion of hours across workers can increase if average hours start diverging **between** establishments or if the dispersion of hours **within** establishments rises. The distinction is important because it can yield useful insights into the factors underlying the growth in dispersion. If, for instance, increases in employers' contributions to Canada's pension plan, Unemployment Insurance and Workers' Compensation make firms reluctant to hire permanent full-time employees and lead them to either make greater use of part-time employment (for low-skilled workers) or require longer hours for their highly skilled workers, then the dispersion of hours within establishments should rise. On the other hand, greater product specialization could increase the heterogeneity of work schedules between establishments and thus increase the dispersion of hours between establishments<sup>23</sup>.

To assess the extent to which the growth in dispersion of hours across workers results from rising dispersion within establishments rather than between establishments, we decompose the variance of weekly hours across workers  $V$  as follows:

$$(1) \quad V = V(b) + V(w)$$

where  $V(b)$  is the variance of hours across establishments and  $V(w)$  is an employment-weighted sum of variances of hours within establishments<sup>24</sup>. The variance of weekly hours

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<sup>22</sup> For a discussion of the methodology underlying the decomposition of these inequality indexes, see Morissette, Myles and Picot (1993).

<sup>23</sup> Davis and Haltiwanger (1991) cite results from Gollop and Monohan (1989) about the growth in product specialization observed in the U.S. manufacturing sector between 1967 and 1982. They argue that increasing product specialization may have affected movements in wage dispersion within plants.

<sup>24</sup> The exact formula is the following. Let  $H_e$  and  $H$  be the average weekly hours in establishment  $e$  and at the aggregate level, respectively. Let  $p_e$  be the share of establishment  $e$  in total employment (measured as the number of workers) and  $V_e$  be the variance of weekly hours across workers of a given establishment. Then, it can be shown that  $V$ , the variance of weekly hours across workers, equals :

across workers  $V$  can be estimated using data from the Labour Force Survey while  $V(b)$  can be estimated using data from the Survey of Employment, Payroll and Hours (SEPH). The variance of hours within establishments is determined residually. Since the data from SEPH is available only for the period 1982-1993,  $V(b)$  and  $V(w)$  can be estimated only for this time interval<sup>25</sup>.

Figure 8 plots the three terms of equation (1) for all major industrial groups of the commercial sector. Four points are worth noting. First, between 1982 and 1991, the variance of weekly hours across workers  $V$  displays no clear trend<sup>26</sup>. Second, most of its year-to-year variation appears to result from fluctuations in the dispersion of hours within establishments. For instance, between 1989 and 1990, the variance of hours across workers and the variance of hours within establishments both dropped roughly 5 points in manufacturing. This decrease in the variance of hours within establishments coincides with a reduction in hours of overtime observed in manufacturing in the midst of the 1990-92 recession. Third, after 1991, both  $V$  and  $V(w)$  have increased substantially in all sectors except consumer services. Specifically, in forestry and mining, manufacturing, distributive services and business services, the growth in the variance of hours within establishments accounts for at least 90% of the growth in the variance of hours across workers between 1991 and 1993. The only exceptions are consumer services - for which  $V$  displays little change - and the construction industry, in which the growth in the variance of hours between establishments explains three quarters of the increase in the variance of hours across workers  $V$  during that period. Fourth, between 1982 and 1993, the dispersion of weekly hours between establishments has risen at least 25% in all three industrial groups of the goods-producing sector (i.e. forestry and mining, construction, manufacturing). Taken together, these results suggest that both factors which influence the dispersion of hours **within** establishments and those which affect the dispersion of hours **between** establishments are important to understand the growing dispersion of hours across workers<sup>27</sup>.

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$$V = \sum p_e * (H_e - H)^2 + \sum p_e * \text{Var}_e \quad (1)$$

The first term of the right-hand side of equation (1) is the (employee-weighted) variance of hours between establishments and is equal to  $V(b)$ . The second term is a weighted sum of establishment-specific variances; it is equal to  $V(w)$ .

<sup>25</sup> Davis and Haltiwanger (1991) perform a similar decomposition for the variance of hourly wages across hours worked in the manufacturing sector. Weekly hours worked are not available from SEPH for "other" employees (employees who are neither paid by the hour nor salaried) while they are available from LFS. Because of that exclusion, the sample of workers implicitly selected from SEPH differs slightly from that used with LFS. Between 1982 and 1993, other employees accounted for between 2.5% to 4.0% of all employees.

<sup>26</sup> This is not inconsistent with the fact that the dispersion of weekly hours worked increased for men in the eighties (Table 2). The difference is simply due to the inclusion of women in the sample and to the fact that hours dispersion has not increased among women in the eighties. Morissette and Sunter (1994) showed that the drop in women's part-time employment between 1983 and 1989 was responsible for the lack of growth in hours dispersion among women.



## VI. The Correlation Between Wages and Weekly Hours Worked

As suggested by Table 2, the correlation between weekly hours worked and hourly wage rates rose between 1981 and 1984. The Pearson correlation coefficients, which were equal to -0.012 and -0.038 in 1981 for men and women, respectively, varied between 0.050 and 0.106 between 1984 and 1990 (Table 12). While these coefficients highlight the growing tendency of employees earning high wages to work long hours, they remain fairly abstract. An alternative is to plot mean weekly hours worked by workers at the bottom, middle and top quintile of the distribution of **weekly** wages (Figure 9). As pointed out earlier, the time path of weekly hours worked differs drastically between male workers in the top quintile and those in the bottom quintile. Weekly hours worked by men in the bottom quintile dropped 5% between 1981 and 1984 and never returned to their pre-recession level afterwards. In contrast, weekly hours worked by men in the top quintile remained fairly constant between 1981 and 1984 and rose more roughly 5% during the remainder of the eighties. More moderate differences are found among women.

Is the growing propensity of high-wage employees to work longer hours specific to one particular sector? To answer this question, we first look at the distribution of weekly wages within each industrial group and for men and women separately. Specifically, we compute mean weekly hours worked at the bottom, middle and top quintile of each sex/industry-specific distribution of weekly wages. The results are reported in Table 13 and show essentially that the increasing tendency of individuals earning high wages to work long hours is not limited to one particular industry; it is observed in all major industrial groups. For instance, between 1981 and 1988, weekly hours worked by men in the top quintile rose by at least 2 hours for all major industrial groups except construction. In contrast, hours worked by men in the bottom quintile either fell or remained virtually unchanged in all industrial groups<sup>28</sup>. Secondly, we calculate, for each gender and union

<sup>27</sup> One can assess the contribution of changes in  $V(b)$  and  $V(w)$  to the growth of  $V$  between 1984 and 1993 - two years for which the unemployment rate stood at 11.2% . When we do so, we find that : 1) the growth in  $V(w)$  accounts for at least 65% of the growth in  $V$  in forestry and mining and in distributive services, 2) the growth in  $V(b)$  explains 70% of the growth in  $V$  in construction and, 3) increases in  $V(b)$  and  $V(w)$  account each for roughly half of the growth in  $V$  in manufacturing and business services.

<sup>28</sup> We also decomposed the increase in the covariance between log weekly hours and log hourly wages into : 1) a between-industry component and, 2) a within-industry component. Let  $Cov(h,w)$  and  $Cov_j(h,w)$  be the covariance between log weekly hours and log hourly wages : 1) at the aggregate level and, 2) for industry  $j$ , respectively. Define the average log weekly hours ( $\mu_h$ ), the average log hourly wages ( $\mu_w$ ) at the aggregate level as well as their counterparts for industry  $j$  ( $\mu_{hj}$  and  $\mu_{wj}$ ). Then, it can be shown that :

$$Cov(h,w) = \sum p_j * Cov_j(h,w) + \sum p_j (\mu_{hj} - \mu_h) * (\mu_{wj} - \mu_w) \quad (1)$$

where  $p_j$  is the share of industry  $j$  in total employment. The first-term on the right-hand side of equation (1) is a weighted sum of industry-specific covariances and measures the within-industry component. The second term equals the between-industry covariance. We calculated equation (1) for 1981 and 1988. For both men and women, at least 75% of the increase in the covariance is due to an increase in the within-industry component. This means that the growing tendency of highly paid workers to work longer workweeks is observed in most industries and confirms the results of Table 13.

status, mean weekly hours worked at the bottom, middle and top quintile of the relevant distribution of weekly wages (Table 14). For both men and women, weekly hours worked by employees in the top quintile have grown in both the unionized and the non-unionized sector. Thus, the increasing correlation between weekly hours worked and wages is neither limited to one industry nor to non-unionized jobs.

## VII. Why Has Inequality in Weekly Earnings Increased in Canada?

In our view, any set of explanations of the increase in inequality in weekly earnings must reconcile the three following facts :

- 1) real hourly wages of young workers fell substantially between 1981 and 1986 and never returned to their pre-recession level afterwards;
- 2) the dispersion of weekly hours worked rose with the onset of the 1981-82 recession and - at least for men - never returned to its pre-recession level;
- 3) the correlation between hourly wage rates and weekly hours worked increased between 1981 and 1986 and never returned to its pre-recession level.

Most of the explanations which have been put forward so far to explain the growth in inequality in annual earnings in the United States refer implicitly to the growing dispersion of either **weekly** wages (Katz and Murphy 1992) or **hourly** wages (Murphy and Welch 1992). Little attention has been paid to the potential influence of changes in the distribution of weekly hours of work. In this section, we first review various explanations based on inequality in either weekly or hourly wage rates. Since inequality in hours worked play also an important role, we then ask why the distribution of weekly hours worked has changed in Canada.

### VII.1 Explanations based on the growing dispersion of weekly or hourly wage rates

#### *De- industrialization and de-unionization*

The de-industrialization hypothesis assumes that the distribution of employment shifted away from manufacturing and towards a service sector polarized among a set of high wage "knowledge" jobs on one hand and low wage personal service jobs on the other (Bluestone and Harrison, 1982). Such changes in the distribution of employment by industry should lead to an increase in inequality in **hourly wages** at the aggregate level and may explain part of the decline in real wages of young workers. A second argument, the de-unionization hypothesis, points out changes in the relative importance of the unionized sector as a potential determinant of the growth in earnings inequality (Freeman, 1991). More precisely, because the dispersion of hourly wages is greater in non unionized jobs



than in unionized jobs, any decrease in unionization should induce growth in hourly wage inequality.

There are three reasons why de-industrialization and de-unionization are unlikely to explain most of the growth in weekly wage inequality in Canada. First, the changes in the dispersion of weekly hours worked and the growth in the correlation between wages and weekly hours - two important sources of growth in weekly wage inequality - are observed within most industries and within both unionized and non-unionized jobs. Second, the decline in unionization has been much less pronounced in Canada than in the United States<sup>29</sup>. Third, most of the decline in youth relative wages remains even after controlling for industry affiliation and union status (Betcherman and Morissette, 1994). To assess the contribution of de-industrialization and de-unionization, we decompose the growth in weekly earnings inequality into : 1) growth in inequality due to changes in the distribution of employment by sector (or changes in **weights**), 2) growth in inequality **within** sectors and, 3) growth in inequality **between** sectors. The second panel of Table 15 shows the results of these decompositions. The sectors are defined either separately (columns 1-2) or jointly (column 3) in terms of industry and union status. We perform these decompositions using the Theil-Entropy index and the square of the coefficient of variation<sup>30</sup>. For both inequality measures, changes in the distribution of employment by industry only or by union status only account for 22% of the growth in weekly wage inequality among men. Changes in the distribution of employment by industry **and** union status explain 28-30% of the rise in dispersion of male weekly wages. As expected, most of the growth in inequality - i.e. between 55% and 62% of the increase observed between 1981 and 1988 - occurs within sectors defined jointly in terms of industry and union status. Among women, changes in the composition of employment by sectors defined jointly in terms of industry and union status account for 7% -14% of the growth in inequality. Thus, while industrial shifts and changes in the unionization rate are significant, they are not the dominant factors behind the growth of weekly wage inequality.

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<sup>29</sup> In our sample, the proportion of men in unionized jobs decreases from 41.9% in 1981 to 39.4% in 1988 while the proportion of women **ris**es slightly from 30.0% to 31.1%. In contrast, the unionization rate in the United States has declined from roughly 30% in 1970 to 16% in 1990 (Riddell 1993).

<sup>30</sup> Since the **square** of the coefficient of variation and the Theil-Entropy index are decomposable - the Gini coefficient is not - the decomposition is done using these two inequality measures. The formulas used for the decomposition are the following. The square of the coefficient of variation ( $CV^2$ ) =  $\sum p_i cv_i^2 r_i^2 + \sum p_i (1 - r_i^2)$ ; Theil-Entropy (TE) =  $\sum p_i r_i \ln(r_i) + \sum p_i r_i TE_i$ , where  $r_i = m_i / m$ ,  $m_i$  are mean earnings of group  $i$ ,  $m$  are overall mean earnings,  $p_i$  is the proportion of individuals in group  $i$ , and  $cv_i^2$  and  $TE_i$  are measures of inequality for group  $i$ . The results of Tables 11 and 15 are derived by changing  $r_i$  first, then changing group-specific measures of inequality and finally changing  $p_i$ .

### *Skill-biased technological change*

A third explanation widely used to understand the growth in earnings inequality in the United States is that technological change has increased the demand for highly skilled workers in the eighties, widening the hourly wage differentials between highly experienced/educated workers and young low-educated workers (Bound and Johnson 1992, Katz and Murphy 1992). While hourly wage differentials between age groups have risen substantially, hourly wage differentials between education levels have not increased as much as in the United States. For instance, among American men with 1-5 years of experience, the ratio of hourly wages of university graduates to hourly wages of high school graduates grew from 1.30 to 1.74 between 1979 and 1989 (Murphy and Welch 1992, 300). In contrast, among Canadian men aged 17-24, that ratio grew from 1.27 to 1.35 between 1981 and 1988. Freeman and Needels (1991) argue that the faster growth of the supply of university graduates in Canada, the greater strength of Canadian unions, faster growth of real GDP and a better external trade have restricted the widening of the wage differentials between education levels in Canada. In addition to these factors, the compression of hourly wages in the unionized sector - documented above - seems to have played a role<sup>31</sup>. Yet even though hourly wage inequality has not risen as much in Canada as in the United States, the evolution of hourly wage differentials between age/education groups appears broadly consistent with the technological change hypothesis<sup>32</sup>.

### *Reduction in real minimum wages*

Between 1981 and 1988, real minimum wages fell between 6% and 20%, depending on the province selected. This may have decreased hourly wages of young workers, increasing hourly wage inequality and thus weekly wage inequality. To assess the extent to which the drop in real minimum wages may explain the decline in real wages of youth between 1981 and 1988, we use a crude procedure. We inflate by 20% wages of young workers which were - in 1988 - equal to or below \$4.75, i.e. the highest minimum wage observed that year and imposed both in Quebec and Ontario. We then recalculate the 1988 hypothetical mean hourly wage resulting from this adjustment. When this is done, real hourly wages of young men fall by 15.2% between 1981 and 1988; during that period, they actually fell 16.1%. Real hourly wages of young women drop 10.6%, which is very

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<sup>31</sup> We estimated the previous hourly wage equations for unionized men and non-unionized men separately, for 1981 and 1988. In unionized jobs, the ratio of hourly wages of university graduates to those of individuals with 9-13 years of schooling (derived after controlling for marital status, industry affiliation, region of residence and full-time/part-time status) fell from 1.27 to 1.17 among men aged 35-44 and from 1.37 to 1.32 among men aged 45-54. In non unionized jobs, that ratio rose from 1.29 to 1.42 among men aged 35-54. Men aged 35-54 accounted for 40% to 50% of unionized men between 1981 and 1988.

<sup>32</sup> The relative unemployment rates by education level also provide some evidence of an increasing demand for high-skill workers. Between 1981 and 1989, the ratio of the unemployment rate of individuals with 0-8 years of schooling to that of university graduates rose from 3.0 to 3.9 among individuals aged 15-24 and from 3.3 to 3.7 among individuals aged 25-34.



close to the observed decrease of 12.0%. While the procedure outlined above does not take account of potential indirect wage increases which might have been observed among young workers paid **above** minimum wages, it suggests that the decline in real minimum wages is unlikely to explain a substantial fraction of the decrease in youth real wages.

### ***Decline of average firm size***

During the eighties, average firm size declined in Canada (Wannell 1991). Specifically, data from the Longitudinal Employment Analysis Program (LEAP) in Statistics Canada show that the proportion of workers employed in firms with less than 20 employees rose from 18.4% to 20.4% while the percentage of individuals employed in firms with 500 employees or more fell from 51.3% to 46.4% between 1981 and 1988. Since young workers are overrepresented in small firms, this change in the distribution of employment by firm size may potentially affect the wage gap between young and older workers. To assess whether this is the case or not, we calculated the hypothetical wage gap which would have prevailed in 1988 had the distribution of employment by firm size remained constant at its 1981 value<sup>33</sup>. Between 1981 and 1988, the ratio of hourly wage rates of workers aged 17-24 to those of workers aged 25-64 dropped from 0.72 to 0.60. When we hold the distribution of employment constant to its 1981 value, that ratio remains unchanged at 0.60. This suggests that the decline of average firm size had very little effect on the wage differentials across age groups<sup>34</sup>.

## **VII.2 Why Has the Distribution of Weekly Hours of Work Changed in Canada?**

### ***Changes in labour supply induced by the stagnation of real annual earnings***

A priori, changes in labour supply may be invoked to explain the growth in hours dispersion. In an economy where real annual earnings have been stagnating over the recent years, the growing proportion of employees working 50 hours per week or more could reflect workers' decisions to increase their weekly hours worked in order to maintain or increase their real annual earnings. We do not think this is a dominant factor for two reasons. First, real annual earnings of full year full-time workers have been stagnating since the mid-seventies. Yet the propensity to work long workweeks started rising **right**

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<sup>33</sup> Since the Survey of Work History of 1981 does not contain information on firm size, we proceeded as follows. First, we calculated the distribution of employment by firm size for 1981 and 1988 using the LEAP file. We defined four size classes (less than 20 employees, 20-99, 100-499 and 500 employees or more). We calculated the **change** in the proportion of workers employed in these size classes between 1981 and 1988. Second, we added that change to the percentage of workers employed in these size classes from LMAS 1988.

<sup>34</sup> Two opposite forces play a role here. The increase in the proportion of small firms - which employ a disproportionate share of young workers - tends to decrease average wages of young workers. However, the decrease in the proportion of large firms - in which older workers are overrepresented - tends to pull down average wages of these workers. Thus, the net effect of these two factors is unknown a priori.

**after** the 1981-82 recession, not in the mid-seventies. Thus, the timing of the two events seems to be problematic. A counter-argument would be that it takes many years of data showing constant real earnings before analysts - and thus, *a fortiori*, households - realize that their real annual earnings have been stagnating and adjust their labour supply accordingly. Second, and more important, the increase in hours worked occurs mainly among workers in the top quintile of the weekly wage distribution. If highly paid workers started working more hours to increase their standard of living, why haven't low paid workers done the same? In fact, hours worked by employees in the bottom quintile of the weekly wage distribution **fell** between 1981 and 1988.

One possible explanation is that low paid workers were more constrained in their choice of hours in 1988 than in 1981 and that this would explain why mean hours in the bottom quintile have not increased. This is not the case. While the extent of rationing did rise somewhat between 1981 and 1988, this cannot explain why the average workweek has not risen for workers in the bottom quintile. In 1981, men in the bottom quintile would have preferred to work, on average, 4.3 additional hours per **month** while they would have preferred to work 5.6 additional hours per **month** in 1988<sup>35</sup>. Measured this way, the degree of rationing has increased by 1.6 hours per month, or roughly 0.4 hours per week. Yet if working time had increased by 0.4 hours per week, men in the bottom quintile would have worked on average only 31.3 hours per week (i.e.  $30.9 + 0.4$ ), compared to 32.8 hours in 1981. Another possibility is that the decrease in average weekly hours for workers in the bottom quintile merely reflects growing participation of young students in full-time jobs. The data does not support that contention. Among men aged 25 to 54 - a subsample which excludes most full-time students - average weekly hours worked in the bottom quintile have dropped from 39.0 to 37.8 between 1981 and 1988 while those worked by men in the top quintile have increased from 42.8 to 45.3. Thus, the decline in average weekly hours worked among low-paid workers does not result simply from growth in part-time employment among young workers or full-time students. A third argument assumes that attitudes of low-wage workers towards work differ from those of high-wage workers; the latter group may have decided to increase their weekly hours to maintain or increase their real annual earnings while the former may have preferred not to do so. We cannot rule out this possibility.

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<sup>35</sup> The degree of rationing is calculated as follows. In the Survey of Work History of 1981, whenever an individual works less than 6 hours per day or 5 days per week or 4 weeks per month, the following question is asked : "...how many additional hours per month would you have preferred to work for this employer?". If the number of additional hours is greater than zero, the next question is asked : "What were the reasons why you did not work these additional hours?" One possible reason is that "additional hours [were] not offered by [the] employer". The average number of additional hours men in the bottom quintile would have preferred to work per month is obtained simply by : 1) summing the total number of additional hours per month which were not worked because they were not offered by employers and, 2) dividing the resulting number by the number of men in the bottom quintile. The same procedure is used for the Labour Market Activity Survey of 1988.



### *Changes in labour supply induced by tax changes*

Alternatively, some workers may have increased their labour supply in response to the tax changes introduced in the 1980s. The 1988 federal tax reform, while simplifying the structure of tax brackets from ten to three, reduced the top marginal income tax rate from 34% (prior to 1988) to 29%. The reduction in the top marginal income tax rate at the federal level was far from the only tax change which occurred in the 1980s. In Ontario, provincial income tax rose as a percentage of basic federal tax, high income surtaxes were introduced and the level of taxable income sufficient to trigger the high-income surtax has fallen. In addition to socio-economic characteristics of individuals (e.g. marital status, number of children), all these factors must be taken into account to calculate **effective** marginal tax rates. In a recent study, Murphy, Finnie and Wolfson (1993) use the Social Policy Simulation Database and Model (SPSDM) of Statistics Canada to do so. They compute the effective marginal tax rates of Ontario tax filers. In Figure 10, we plot these marginal tax rates along with mean weekly hours for each quintile of the distribution of annual wages<sup>36</sup>. The population selected consists of male paid workers aged 17 to 64 and employed in Ontario. Since SWH-SUM-LMAS and SPSPDM can be used jointly only for the period 1984-1990, we restrict our analysis to this time interval.

The time paths of the marginal tax rates computed differ across quintiles. Between 1984 and 1990, marginal tax rates in the bottom quintile rose from 20% to 24% while those in the top quintile fell slightly, from 54% to 52%. Are tax-induced changes in labour supply likely to explain fully the changes in the distribution of weekly hours? The answer is no. The biggest increase in average weekly hours is observed in the top quintile between 1984 and 1986; during that period, weekly hours have risen from 43.1 to 47.0. Yet the marginal tax rate in the top quintile remained essentially unchanged during that period. Since average weekly hours in the top quintile rose from 42.6 to 46.2 between 1981 and 1989 - two years roughly comparable in terms of macroeconomic conditions - it is unlikely that the increase observed between 1984 and 1986 reflects simply a cyclical effect.

More fundamentally, changes in the relative supply of various age/education groups cannot fully explain the changes in the structure of either weekly or hourly wages. Between 1981 and 1988, the relative supply of young male employees with 9-13 years of schooling (as measured by their share of total weekly hours worked by male employees) has dropped from 14% to 10%. Meanwhile, their real hourly wages fell by 19%. This simple fact implies that changes in labour demand must be incorporated in any coherent explanation of the growth in inequality in weekly earnings.

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<sup>36</sup> We calculate a distribution of hypothetical annual wages by multiplying weekly earnings by 52 weeks.

### *Changes in labour demand*

While it has been possible to confront the previous explanations with the data, others cannot be tested directly. One explanation relies on a theory of internal labour markets and suggests that in response to stronger competitive pressures, Canadian firms may have adjusted in the following way in the eighties. First, to maintain employees' morale among their experienced workforce, they may have cut labour costs mainly by decreasing hourly wages in entry-level jobs, i.e. among young workers. Second, to introduce flexibility in the management of their workforce, they may have increased the use of part-time employment for employees for which training costs/turnover expenditures are low while requiring longer hours for those high-skill/highly paid workers. This would explain the increase in hourly wage differentials across age groups, the growth in the dispersion of weekly hours and the rise in the correlation between weekly hours worked and hourly wage rates.

Another view is that increases in fixed costs of hiring may have made firms reluctant to hire new workers (Business Week 1993). Employer expenditures for programs like the C/QPP and Unemployment Insurance as well as employer contributions for fringe benefits typically stop when employee earnings rise above a specified level. As a result, it is advantageous for employers to utilize higher paid employees for longer hours instead of hiring additional workers to increase output. The shift to a high skill labour force compounds the problem. When the skills required are firm specific and training costs are absorbed by the employer, an increase in training costs may induce firms to employ trained workers for longer hours rather than to add new employees - whether they would work full-time or part-time - who require additional training costs. Conversely, whenever the skill requirements and training costs are low, high expenditures on supplementary labour income for permanent employees may lead firms to make greater use of part-time workers, for which fringe benefits are usually low or nonexistent.

A third argument is that the relatively slack labour market of the eighties may have shifted the bargaining power (between firms and workers) towards firms. If such a shift occurred, it may have allowed firms to require longer workweeks from part of their workforce and reduce labour costs mainly by cutting wages in entry-level jobs.

Technological changes which increase the locational mobility of firms may have increased competition and/or shifted the bargaining power towards firms. The increase in Canada's openness to trade may also have had these two effects. Between 1983 and 1993, the ratio of the sum of real exports and real imports to GDP at factors costs has risen from 43% to 68% (Figure 11).

Employers' expenditures for C/QPP, UI, Workers' Compensation, private pensions and welfare items (including Quebec and Ontario's payroll tax) have also been rising relative to wages and salaries since the mid-sixties (Figure 12). However, given that these fixed costs of labour increased during the **second half of the seventies** as well as during the eighties, one may wonder why - at least for men - the dispersion of weekly hours has not increased



during the second half of the seventies. One possible answer is that the constraints associated with the growth of these costs did not operate until after the 1981-82 recession, when increasing competitive pressures may have led firms to restructure, trim staff and cut labour costs<sup>37</sup>.

There is no data that measures directly changes in training costs over time. However, if one assumes that training costs are higher in firms which are capital-intensive<sup>38</sup>, the time path of the capital/labour ratio may provide indirect evidence on trends in training costs. In the business sector, the capital-labour ratio has been fairly constant in the second half of the eighties and increased markedly between 1989 and 1993 (Figure 13). As a result, it rose 37% between 1981 and 1993. We interpret that as slight evidence that training costs may have increased during that period. In the case of employment spells involving firm-specific training, workers' wages may start below their productivity levels and then exceed productivity. An increase in training costs in all sectors of the economy could make the age-earnings profile steeper, i.e. lead firms to offer lower wages in the early phase of an employment spell and then increase their wages. This could explain the growing wage gap between young and older workers.

While it is hard to disentangle the contribution of the various factors identified above, the bottomline is that the relatively slack labour market of the eighties, the growth in competitive pressures, technological changes, the greater openness of the Canadian economy to trade, increases in fixed costs of labour and possible increases in training costs may all have affected firms' demand for labour and are likely to explain part of the growing dispersion of weekly hours of work.

## VIII. Conclusion

Inequality in weekly earnings increased in the eighties in Canada. The increase in inequality occurred in conjunction with three facts. First, real hourly wages of young workers fell substantially. Second, the percentage of employees working 35-40 hours per week declined while the fraction of employees working either shorter or longer hours rose. Third, there was a growing tendency for highly paid workers to work longer workweeks.

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<sup>37</sup> Ideally, one would like to construct, for each industry, measures of the intensity of competition and of the supplementary labour income and use these as regressors to explain trends in the dispersion of weekly hours. While one could construct measures of competitive pressures from the longitudinal version of the Census of manufactures (e.g. looking at trends in market shares transferred from growing to declining firms), it is impossible to produce reliable estimates of supplementary labour income for 2-digit industries.

<sup>38</sup> The Human Resource Training and Development Survey showed that in 1987, companies with 1,000 or more employees spent on average \$260 per employee (for formal training), compared to \$100 per employee for companies with 10-49 employees. This suggests that training costs are higher in large firms than in small firms. Since large firms are more capital-intensive than small firms, this indicates that the capital-labour ratio may be positively correlated with training costs.

Any set of explanations of the growth in inequality must take these three facts into account.

The first wave of U.S. studies on the growth of earnings inequality (e.g. Bluestone and Harrison, 1982) argued that industrial shifts in the distribution of employment were largely responsible for the movements observed. This paper, along with subsequent U.S. studies (e.g. Katz and Murphy, 1992), has shown that de-industrialization cannot explain the bulk of the growth in inequality. When combined with changes in the unionization rate, changes in the distribution of employment by industry (at the one-digit level) account for roughly 30% of the growth in weekly earnings inequality. Other factors, such as the drop in real minimum wages and the decline of average firm size explain very little of the growth in age-earnings differentials.

The second wave of U.S. studies (e.g. Bound and Johnson, 1992) has argued so far that skill-biased technological change is the major factor underlying the changes observed in the structure of wages. Surprisingly, little attention has been paid to the potential influence of changes in the distribution of weekly hours of work. Yet the distribution of weekly hours of work has become more polarized both in Canada and in the United States. If one assumes an economy which consists of two types of workers, highly skilled and low-skilled, and if the labour supplies of each type of labour are upward-sloping, an increase in the relative demand for highly skilled workers could increase both the dispersion of hourly wages and the dispersion of weekly hours of work. Thus the growth in the dispersion of weekly hours of work and in the correlation between hourly wages and weekly hours - which was documented in the previous sections - is not inconsistent, *a priori*, with skill-biased technological change.

However, as MMP (1994) pointed out, other factors could have played an equally important - if not more important - role in Canada. The growth in competitive pressures, (assumed) changes in the power structure between firms and workers, the greater locational mobility of firms, the increase in Canada's openness to international trade, changes in fixed costs of labour and possibly in training costs may have led employers to alter both the structure of wages and the dispersion of weekly hours within establishments. The movements in the distribution of weekly hours of work which were documented in this paper suggest that skill-biased technological change may not be the only culprit behind the rise in weekly earnings inequality in Canada.



**Table 1 : Weekly Earnings, Weekly Hours Worked and Hourly Wages at Various Quintiles, 1981-1988 <sup>1</sup>**

	1981	1988	% change
<b>Men</b>			
Quintiles			
1st			
Weekly earnings	143.90	138.40	-3.8 %
Weekly hours	32.8	30.9	-5.8 %
Hourly wages	4.78	4.80	0.4 %
2nd			
Weekly earnings	271.95	283.66	4.3 %
Weekly hours	41.1	41.4	0.7 %
Hourly wages	6.76	7.02	3.8 %
3rd			
Weekly earnings	359.54	377.62	5.0 %
Weekly hours	40.9	41.7	2.2 %
Hourly wages	8.99	9.25	2.9 %
4th			
Weekly earnings	451.88	484.81	7.3 %
Weekly hours	41.0	42.2	2.9 %
Hourly wages	11.24	11.71	3.6 %
5th			
Weekly earnings	666.01	728.85	9.4 %
Weekly hours	42.6	45.0	5.6 %
Hourly wages	16.03	16.65	3.9 %
<b>Women</b>			
Quintiles			
1st			
Weekly earnings	71.71	71.37	-0.5 %
Weekly hours	18.4	18.0	-2.2 %
Hourly wages	4.78	4.57	-4.4 %
2nd			
Weekly earnings	159.00	157.89	-0.7 %
Weekly hours	33.8	33.5	-0.9 %
Hourly wages	5.30	5.28	-0.4 %
3rd			
Weekly earnings	224.03	230.50	2.9 %
Weekly hours	37.5	36.9	-1.6 %
Hourly wages	6.29	6.59	4.8 %
4th			
Weekly earnings	296.90	307.19	3.5 %
Weekly hours	38.1	38.4	0.8 %
Hourly wages	8.08	8.22	1.7 %
5th			
Weekly earnings	470.44	505.09	7.4 %
Weekly hours	38.9	40.0	2.8 %
Hourly wages	12.49	12.92	3.4 %

1. Mean weekly earnings and mean hourly wages expressed in 1981 constant dollars. Workers are sorted by ascending order of their **weekly** earnings and thus quintiles refer to weekly wages in this table.

Source : Survey of Work History of 1981 and Labour Market Activity Survey of 1988.

**Table 2 : Variance of Log Weekly Earnings, Variance of Log Weekly Hours and Variance of Log Hourly Wages, 1981-1990**

	(1) Variance of log weekly earnings	(2) Variance of log weekly hours	(3) Variance of log hourly wages	(4) Covariance term
<b>Men</b>				
1981	0.405	0.117	0.252	0.036
1984	0.473	0.136	0.252	0.085
1986	0.478	0.130	0.275	0.073
1987	0.454	0.123	0.265	0.066
1988	0.469	0.136	0.257	0.076
1989	0.462	0.138	0.258	0.065
1990	0.493	0.142	0.270	0.081
<b>Women</b>				
1981	0.516	0.247	0.253	0.016
1984	0.567	0.263	0.240	0.064
1986	0.568	0.258	0.257	0.053
1987	0.555	0.251	0.248	0.056
1988	0.562	0.252	0.245	0.065
1989	0.562	0.245	0.252	0.065
1990	0.583	0.249	0.264	0.070

Fraction of the change in the variance of log weekly earnings accounted for by changes in the variance of log weekly hours, changes in the variance of log hourly wages and changes in the covariance between log weekly hours and log hourly wages :

	Weekly hours	Hourly wages	Covariance term
<b>Men</b>			
1981-1984	28%	0%	72%
1981-1986	18%	32%	51%
1981-1987	12%	27%	61%
1981-1988	30%	8%	62%
1981-1989	37%	11%	53%
1981-1990	28%	20%	51%
<b>Women</b>			
1981-1984	31%	-25%	94%
1981-1986	21%	8%	71%
1981-1987	10%	-13%	103%
1981-1988	11%	-17%	107%
1981-1989	-4%	-2%	107%
1981-1990	3%	16%	81%

1. The sample includes paid workers aged 17 to 64. The data is taken from the 1981 Survey of Work History, the 1984 Survey of Union Membership and the 1986-1990 Labour Market Activity Surveys. Weekly earnings are those earned by paid workers in the main job they held in December. The main job is the one associated with the greatest number of weekly hours usually worked.



**Table 3: Hourly Wage Differentials Between Education Levels, 1981-88 <sup>1</sup>**

MEN										
Age group	17-24		25-34		35-44		45-54		55-64	
Year	1981	1988	1981	1988	1981	1988	1981	1988	1981	1988
Ed1 <sup>2</sup>	-0.13 (0.010)	0.00 -	-0.13 (0.010)	-0.20 (0.027)	-0.13 (0.010)	-0.26 (0.021)	-0.13 (0.010)	-0.12 (0.019)	-0.13 (0.010)	-0.16 (0.022)
Ed2	0.00 -	0.00 -	0.00 -	0.00 -	0.00 -	0.00 -	0.00 -	0.00 -	0.00 -	0.00 -
Ed3	0.06 (0.011)	0.08 (0.012)	0.06 (0.011)	0.08 (0.012)	0.06 (0.011)	0.17 (0.020)	0.06 (0.011)	0.22 (0.032)	0.06 (0.011)	0.31 (0.044)
Ed4	0.13 (0.012)	0.20 (0.011)	0.13 (0.012)	0.13 (0.014)	0.07 (0.022)	0.20 (0.011)	0.13 (0.012)	0.20 (0.011)	0.13 (0.012)	0.20 (0.011)
Ed5	0.27 (0.011)	0.27 (0.013)	0.27 (0.011)	0.27 (0.013)	0.27 (0.011)	0.37 (0.020)	0.36 (0.024)	0.39 (0.022)	0.27 (0.011)	0.36 (0.032)
WOMEN										
Age group	17-24		25-34		35-44		45-54		55-64	
Year	1981	1988	1981	1988	1981	1988	1981	1988	1981	1988
Ed1	-0.25 (0.025)	-0.15 (0.015)	-0.25 (0.025)	-0.41 (0.036)	-0.18 (0.022)	-0.15 (0.015)	-0.14 (0.024)	-0.15 (0.015)	-0.14 (0.030)	-0.15 (0.015)
Ed2	0.00 -	0.00 -	0.00 -	0.00 -	0.00 -	0.00 -	0.00 -	0.00 -	0.00 -	0.00 -
Ed3	0.07 (0.013)	0.05 (0.016)	0.07 (0.013)	0.11 (0.022)	0.07 (0.013)	0.15 (0.024)	0.23 (0.040)	-0.04 (0.035)	0.21 (0.063)	0.05 (0.016)
Ed4	0.16 (0.011)	0.19 (0.010)	0.16 (0.011)	0.19 (0.010)	0.16 (0.011)	0.23 (0.014)	0.16 (0.011)	0.19 (0.010)	0.16 (0.011)	0.19 (0.010)
Ed5	0.34 (0.013)	0.26 (0.027)	0.34 (0.013)	0.38 (0.014)	0.34 (0.013)	0.50 (0.017)	0.34 (0.013)	0.42 (0.022)	0.34 (0.013)	0.44 (0.040)

1. The numbers show wage differentials between workers with a given education level and workers with 9-13 years of schooling. The ratio of hourly wages of workers with a given education level to those of workers with 9-13 years of schooling equals the antilog of the coefficients presented in the table. Standard errors are between parentheses. The results are based on a regression of the natural logarithm of hourly wages on the following vector of regressors : 1) one dummy for marital status, 2) four age dummies, 3) four education dummies, 4) sixteen interaction terms between age and education, 5) seven industry dummies, 6) one dummy for union status, 7) one dummy for full-time/part-time job and 8) four region dummies.
2. Ed1 = no schooling or elementary schooling; Ed2 = 9-13 years of schooling; Ed3 = some post-secondary education; Ed4 = post-secondary certificate or diploma; Ed5 = university degree.

Source : Survey of Work History of 1981 and Labour Market Activity Survey of 1988.

**Table 4: Source of Change in the Variance of Log Hourly Wages and in the Variance of Log Weekly Wages, 1981-88**

**Men**

Change in variance of log weekly earnings	=	0.064	100%
Change in variance of log weekly hours		0.019	30%
+ Change in variance of log hourly wages	=	0.005	8%
1) <b>between</b> age groups		0.033	<b>51%</b>
+ 2) <b>within</b> age groups		-0.022	<b>-34%</b>
+ 3) changes in <b>weights</b>		-0.006	<b>-9%</b>
+ Change in covariance term		0.040	62%

**Women**

Change in variance of log weekly earnings	=	0.046	100%
Change in variance of log weekly hours		0.005	11%
+ Change in variance of log hourly wages	=	-0.008	-17%
1) <b>between</b> age groups		0.017	<b>37%</b>
+ 2) <b>within</b> age groups		-0.025	<b>-54%</b>
+ 3) changes in <b>weights</b>		0.000	<b>0%</b>
+ Change in covariance term		0.049	106%

Source : Survey of Work History of 1981 and Labour Market Activity Survey of 1988.



Table 5: Variance of Log Hourly Wages by Age and Union Status, 1981-88

	All Jobs	Unionized Jobs	Non-Unionized Jobs
<b>I. Full sample</b>			
<b>Men</b>			
<b>Aged 17-24</b>			
1981	0.252	0.167	0.257
1988	0.193	0.141	0.175
<b>Aged 25-64</b>			
1981	0.222	0.147	0.279
1988	0.210	0.103	0.283
<b>Women</b>			
<b>Aged 17-24</b>			
1981	0.212	0.147	0.206
1988	0.154	0.125	0.142
<b>Aged 25-64</b>			
1981	0.252	0.163	0.267
1988	0.239	0.136	0.259
<b>II. Workers reporting earnings on an hourly basis</b>			
	All Jobs	Unionized Jobs	Non-Unionized Jobs
<b>Men</b>			
<b>Aged 17-24</b>			
1981	0.184	0.120	0.166
1988 <sup>1</sup>	0.162	0.124	0.138
<b>Aged 25-64</b>			
1981	0.163	0.112	0.194
1988 <sup>1</sup>	0.148	0.083	0.181
<b>Women</b>			
<b>Aged 17-24</b>			
1981	0.135	0.126	0.105
1988 <sup>1</sup>	0.118	0.104	0.095
<b>Aged 25-64</b>			
1981	0.166	0.114	0.152
1988 <sup>1</sup>	0.175	0.110	0.159

1. Numbers based on the subset of observations for which the reporting code is available. In 1988, roughly 88% of the observations had reporting codes on the master file.

Source : Survey of Work History of 1981 and Labour Market Activity Survey of 1988.

**Table 6: Percentage of Workers Reporting Earnings on an Hourly Basis, 1981-1989**

	Men	Women
1981	35	36
1984	42	48
1986	49	51
1988	53 <sup>1</sup>	54 <sup>1</sup>
1989	53 <sup>1</sup>	53 <sup>1</sup>

1. Numbers based on the subset of observations for which the reporting code is available. For 1988 and 1989, this includes roughly 88% of the observations from the initial sample.

Source : Survey of Work History of 1981, Survey of Union Membership of 1984 and Labour Market Activity Surveys of 1986, 1988 and 1989.

**Table 7: Variance of Log Hourly Wages Within Age Groups, 1981-1988, Male Workers With Positive Earnings<sup>1</sup>**

	1981	1988
Men aged 17-24	0.473	0.512
Men aged 25-64	0.375	0.390

1. Workers are first sorted by ascending order of hourly wages. Hourly wages are calculated by dividing annual wages and salaries at time t by weeks worked at time t and weekly hours worked at time t+1. The top 10% of the hourly wage distribution is then excluded. The variance of log hourly wages is calculated on the remaining sample.

Source : Survey of Consumer Finances.



**Table 8: Distribution of Weekly Hours Worked, 1981-90**

<b>Year</b>	<b>1981</b>	<b>1984</b>	<b>1986</b>	<b>1987</b>	<b>1988</b>	<b>1989</b>	<b>1990</b>
<b>Men</b>							
<b>Number of hours worked per week</b>							
1-29	6.9	7.8	8.0	7.6	8.5	8.2	8.7
30-34	1.8	2.8	1.9	2.1	1.9	2.1	2.3
35-40	75.3	72.8	71.0	69.0	67.7	65.8	67.0
41-49	7.7	8.7	8.4	9.7	10.0	11.5	10.7
50+	8.5	8.0	10.7	11.7	11.9	12.5	11.4
<b>Women</b>							
<b>Number of hours worked per week</b>							
1-29	25.1	27.1	26.9	25.5	26.5	25.9	26.5
30-34	5.5	6.8	6.1	6.4	6.4	6.0	5.8
35-40	64.1	60.7	60.1	60.7	59.3	59.8	59.1
41-49	3.0	3.1	3.6	4.0	4.4	5.0	4.7
50+	2.4	2.3	3.2	3.5	3.5	3.3	3.8

Source : Survey of Work History of 1981, Survey of Union Membership of 1984 and the Labour Market Activity Surveys of 1986-1990.

**Table 9: Distribution of Weekly Hours Worked by Union Status, 1981-90**

<b>Year</b>	<b>1981</b>	<b>1984</b>	<b>1986</b>	<b>1987</b>	<b>1988</b>	<b>1989</b>	<b>1990</b>
<b>Unionized Men</b>							
<b>Number of hours worked per week</b>							
1-29	3.1	3.1	3.5	3.5	4.1	4.7	5.2
30-34	1.7	2.4	1.8	2.1	1.8	2.0	2.3
35-40	85.2	83.0	81.9	80.8	77.9	76.5	77.0
41-49	5.8	7.1	6.8	7.4	9.1	9.6	8.4
50+	4.3	4.5	6.1	6.2	7.2	7.2	7.2
<b>Non-Unionized Men</b>							
<b>Number of hours worked per week</b>							
1-29	9.6	11.1	11.0	10.1	11.3	10.5	11.0
30-34	1.8	3.1	2.0	2.1	1.9	2.1	2.3
35-40	68.1	65.4	63.8	61.7	61.1	58.6	60.6
41-49	9.0	9.8	9.5	11.1	10.6	12.7	12.0
50+	11.4	10.6	13.7	15.1	15.1	16.1	14.2
<b>Unionized Women</b>							
<b>Number of hours worked per week</b>							
1-29	15.2	19.3	20.5	19.6	21.5	21.1	21.1
30-34	5.6	5.8	5.0	6.0	5.8	5.5	5.5
35-40	74.5	70.1	68.7	68.0	65.7	66.1	65.4
41-49	2.3	2.2	3.3	3.6	3.9	4.5	4.8
50+	2.4	2.6	2.5	2.9	3.1	2.8	3.3
<b>Non-Unionized Women</b>							
<b>Number of hours worked per week</b>							
1-29	29.3	30.8	29.9	28.0	28.7	28.2	29.1
30-34	5.4	7.3	6.6	6.6	6.7	6.3	6.0
35-40	59.6	56.3	56.2	57.6	56.4	56.8	56.1
41-49	3.3	3.5	3.8	4.1	4.6	5.2	4.7
50+	2.4	2.2	3.5	3.7	3.6	3.6	4.1

Source : Survey of Work History of 1981, Survey of Union Membership of 1984 and the Labour Market Activity Surveys of 1986-1990.



**Table 10: Average Weekly Hours of Work by Age and Education Level, Male Employees, 1981 and 1988**

<b>1981</b>					
<b>Age</b>	<b>17-24</b>	<b>25-34</b>	<b>35-44</b>	<b>45-54</b>	<b>55-64</b>
<b>Education level</b>					
None or elementary	38.4	40.5	41.5	40.8	39.5
9-13 years of schooling	36.7	41.5	40.5	40.9	39.2
Some postsecondary	30.2	40.7	40.9	41.4	39.1
Postsecondary certificate/diploma	35.6	40.7	41.3	40.7	39.7
University degree	36.4	40.4	41.0	42.2	40.8
<b>1988</b>					
<b>Age</b>	<b>17-24</b>	<b>25-34</b>	<b>35-44</b>	<b>45-54</b>	<b>55-64</b>
<b>Education level</b>					
None or elementary	41.4	43.9	41.9	41.9	40.6
9-13 years of schooling	34.9	42.4	41.9	40.9	40.7
Some postsecondary	31.8	41.5	41.6	41.8	38.5
Postsecondary certificate/diploma	35.7	41.4	41.0	41.1	38.0
University degree	36.0	41.0	41.8	41.9	41.4
Source : Survey of Work History of 1981 and Labour Market Activity Survey of 1988.					

**Table 11: Decomposition of Change in Dispersion of Weekly Hours of Work, by Age and Education Level, Male Employees, 1981-88**

**I. Dispersion of weekly hours in 1981 and 1988**

	1981	1988	Change in dispersion between 1981 and 1988
Theil-Entropy index	0.031	0.038	0.007
Square of coefficient of variation	0.055	0.068	0.013

**II. Percentage of change in dispersion of weekly hours accounted for by changes in between-group dispersion, changes in within-group dispersion and changes in demographic weights<sup>1</sup>**

	Theil-Entropy index	Square of coefficient of variation
Change in :		
<b>between-group dispersion</b>	14%	8%
<b>within-group dispersion</b>	114%	115%
<b>demographic weights</b>	-28%	-23%

1. The decomposition is based on 25 groups of workers defined jointly by age and education. The age categories are : 1) 17-24, 2) 25-34, 3) 35-44, 4) 45-54, 5) 55-64. The education levels are : 1) none or elementary, 2) 9-13 years of schooling, 3) some postsecondary education, 4) postsecondary certificate or diploma, 5) university degree.

Source : Survey of Work History of 1981 and Labour Market Activity Survey of 1988.



**Table 12: Correlation Coefficients Between Weekly Hours Worked and Hourly Wage Rates, 1981-1990<sup>1</sup>**

	<b>Men</b>	<b>Women</b>
<b>1981</b>	-0.012 (0.0858)	-0.038 (0.0001)
<b>1984</b>	0.103 (0.0001)	0.072 (0.0001)
<b>1986</b>	0.069 (0.0001)	0.050 (0.0001)
<b>1987</b>	0.067 (0.0001)	0.060 (0.0001)
<b>1988</b>	0.092 (0.0001)	0.082 (0.0001)
<b>1989</b>	0.069 (0.0001)	0.081 (0.0001)
<b>1990</b>	0.106 (0.0001)	0.092 (0.0001)

1. Numbers in parentheses show the significance level of the coefficients.

Source : Survey of Work History of 1981, Survey of Union Membership of 1984 and the Labour Market Activity Surveys of 1986-1990.

**Table 13: Mean Weekly Hours Worked at the Bottom, Middle and Top Quintile, by Industry, 1981-88<sup>1</sup>**

	<b>Men</b>		<b>Women</b>	
	<b>1981</b>	<b>1988</b>	<b>1981</b>	<b>1988</b>
<b>Agriculture</b>				
Bottom quintile	25.3	18.4	12.0	13.3
Middle quintile	48.0	53.7	40.0	32.0
Top quintile	50.4	59.3	41.9	43.2
<b>Forestry and Mining</b>				
Bottom quintile	40.4	40.4	28.5	23.8
Middle quintile	41.6	43.1	39.0	39.7
Top quintile	48.4	52.3	39.3	42.3
<b>Construction</b>				
Bottom quintile	38.2	36.9	17.0	16.8
Middle quintile	41.3	43.5	33.6	37.3
Top quintile	44.5	46.1	39.8	40.6
<b>Manufacturing</b>				
Bottom quintile	38.2	38.1	30.9	31.0
Middle quintile	40.3	41.2	38.6	39.5
Top quintile	41.8	44.2	39.6	40.7
<b>Distributive Services</b>				
Bottom quintile	35.9	36.1	22.4	23.0
Middle quintile	41.3	41.4	38.0	38.3
Top quintile	42.6	45.5	38.7	41.0
<b>Business Services</b>				
Bottom quintile	36.3	33.2	26.0	26.1
Middle quintile	41.5	42.0	38.2	38.6
Top quintile	42.7	45.1	39.1	40.1
<b>Consumer Services</b>				
Bottom quintile	17.4	16.2	14.4	13.2
Middle quintile	42.3	42.3	35.3	35.5
Top quintile	42.4	46.6	39.0	40.6
<b>Public Services</b>				
Bottom quintile	31.3	29.6	17.7	17.9
Middle quintile	40.5	40.0	36.8	36.0
Top quintile	40.8	42.5	38.8	40.2

1. For each industry, men and women are sorted separately by ascending order of their weekly wages. Thus, the numbers refer to quintiles defined in terms of **sex/industry-specific** distributions of **weekly** wages.

Source : Survey of Work History of 1981 and Labour Market Activity Survey of 1988.



**Table 14: Mean Weekly Hours Worked at the Bottom, Middle and Top Quintile, by Union Status, 1981-88**

	Men		Women	
	1981	1988	1981	1988
<b>Unionized</b>				
Bottom quintile	36.9	35.7	26.8	22.3
Middle quintile	40.0	40.6	37.7	37.3
Top quintile	41.3	44.3	39.1	40.6
<b>Non-Unionized</b>				
Bottom quintile	29.3	27.0	16.3	16.4
Middle quintile	41.8	43.0	37.3	37.1
Top quintile	43.5	45.6	39.0	40.1

1. For each union status, men and women are sorted separately by ascending order of their weekly wages. Thus, the numbers refer to quintiles defined in terms of **sex/union status-specific** distributions of **weekly** wages.

Source : Survey of Work History of 1981 and Labour Market Activity Survey of 1988.

Table 15: Decomposition of Change in Inequality in Weekly Wages, 1981-88

**I. Inequality measures in 1981 and 1988**

	1981	1988	Change in inequality between 1981 and 1988
<b>Men</b>			
Theil-Entropy index	0.131	0.149	0.018
Square of coefficient of variation	0.276	0.313	0.037
<b>Women</b>			
Theil-Entropy index	0.180	0.194	0.014
Square of coefficient of variation	0.392	0.420	0.028

**II. Percentage of change in inequality in weekly wages accounted for by changes in between-group inequality, changes in within-group inequality and changes in demographic weights<sup>1</sup>**

Decomposition done by :	(1) Industry <sup>2</sup>	(2) Union status	(3) Industry and union status
<b>Men</b>			
Theil-Entropy index			
Change in :			
between-group inequality	17%	6%	17%
within-group inequality	61%	72%	55%
demographic weights	22%	22%	28%
 Square of coefficient of variation			
Change in :			
between-group inequality	11%	-3%	8%
within-group inequality	68%	81%	62%
demographic weights	22%	22%	30%
 <b>Women</b>			
Theil-Entropy index			
Change in :			
between-group inequality	0%	-14%	-7%
within-group inequality	79%	121%	93%
demographic weights	21%	-7%	14%
 Square of coefficient of variation			
Change in :			
between-group inequality	-11%	-14%	-18%
within-group inequality	96%	125%	111%
demographic weights	14%	-11%	7%

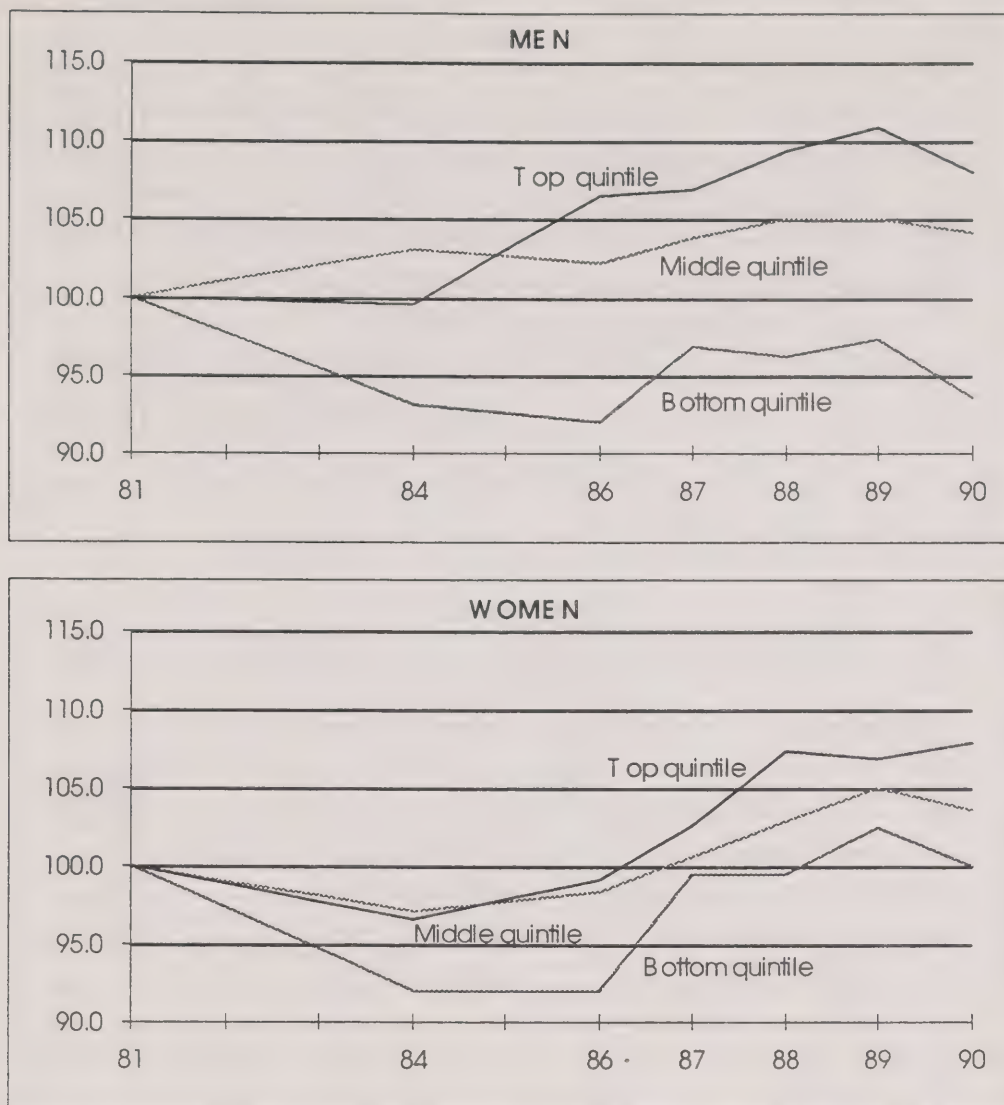
1. Percentages may not add to 100 due to rounding.

2. The major industrial groups used are : 1) Agriculture, fishing and trapping, 2) Forestry and mining, 3) Construction, 4) Manufacturing, 5) Distributive services, 6) Business services, 7) Consumer services and, 8) Public services.

Source : Survey of Work History of 1981 and Labour Market Activity Survey of 1988.

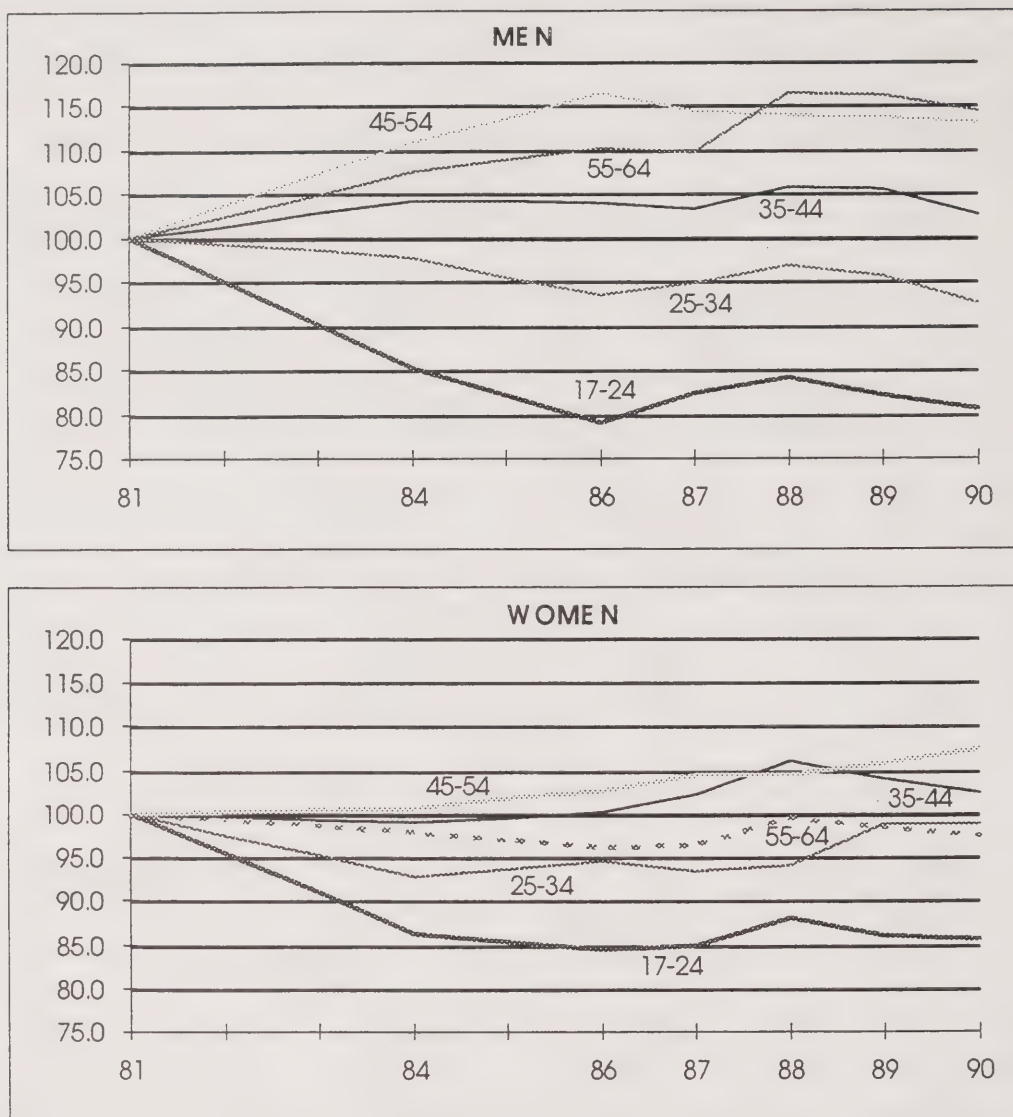


**Figure 1: Indexed real weekly earnings at the bottom, middle and top quintile, 1981-90**



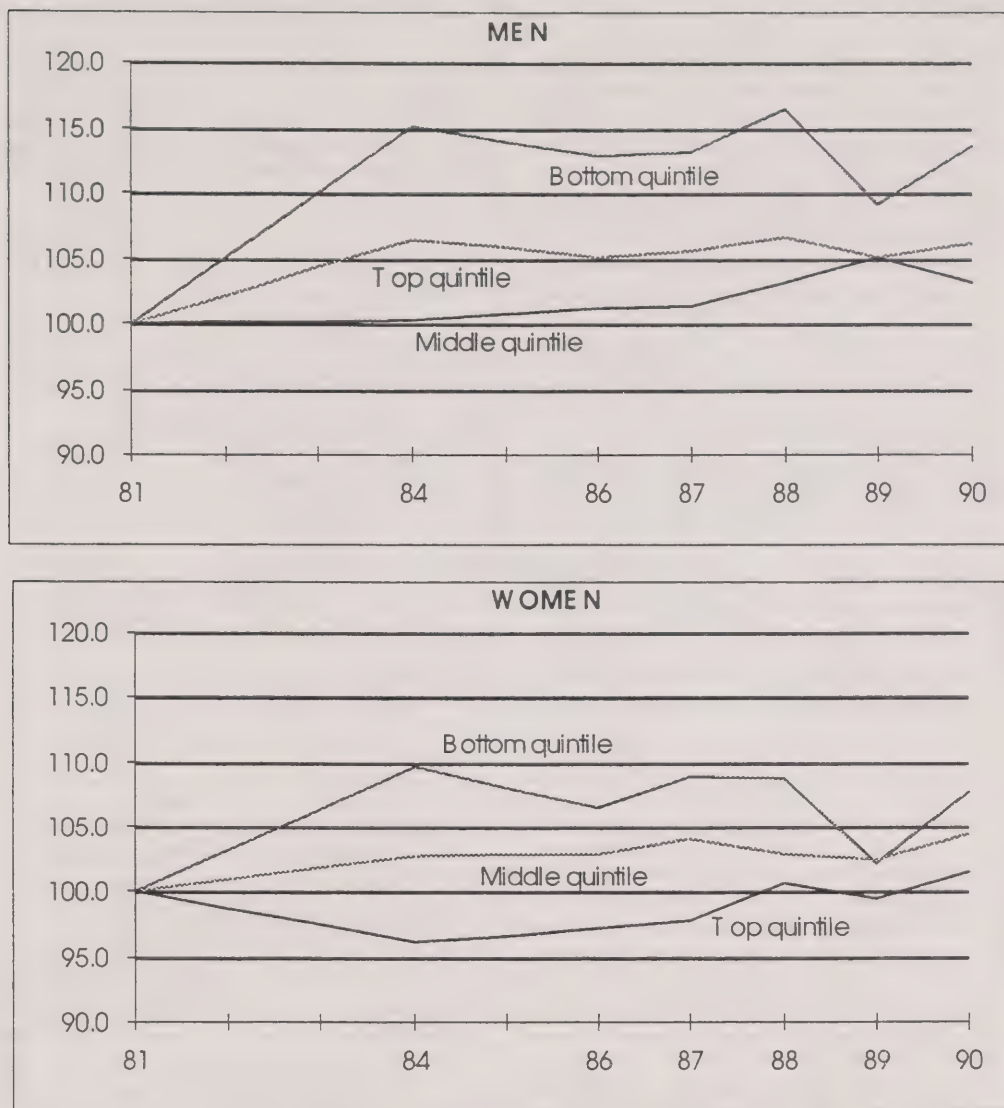
**Source :** Survey of Work History of 1981, Survey of Union Membership of 1984 and Labour Market Activity Surveys of 1986-1990

**Figure 2: Indexed real hourly wages by age group, 1981-90**



Source: Survey of Work History of 1981, Survey of Union Membership of 1984 and Labour Market Activity Surveys of 1986-1990.

**Figure 3: Indexed real hourly wages at the bottom, middle and top quintile, unionized sector, 1981-90**

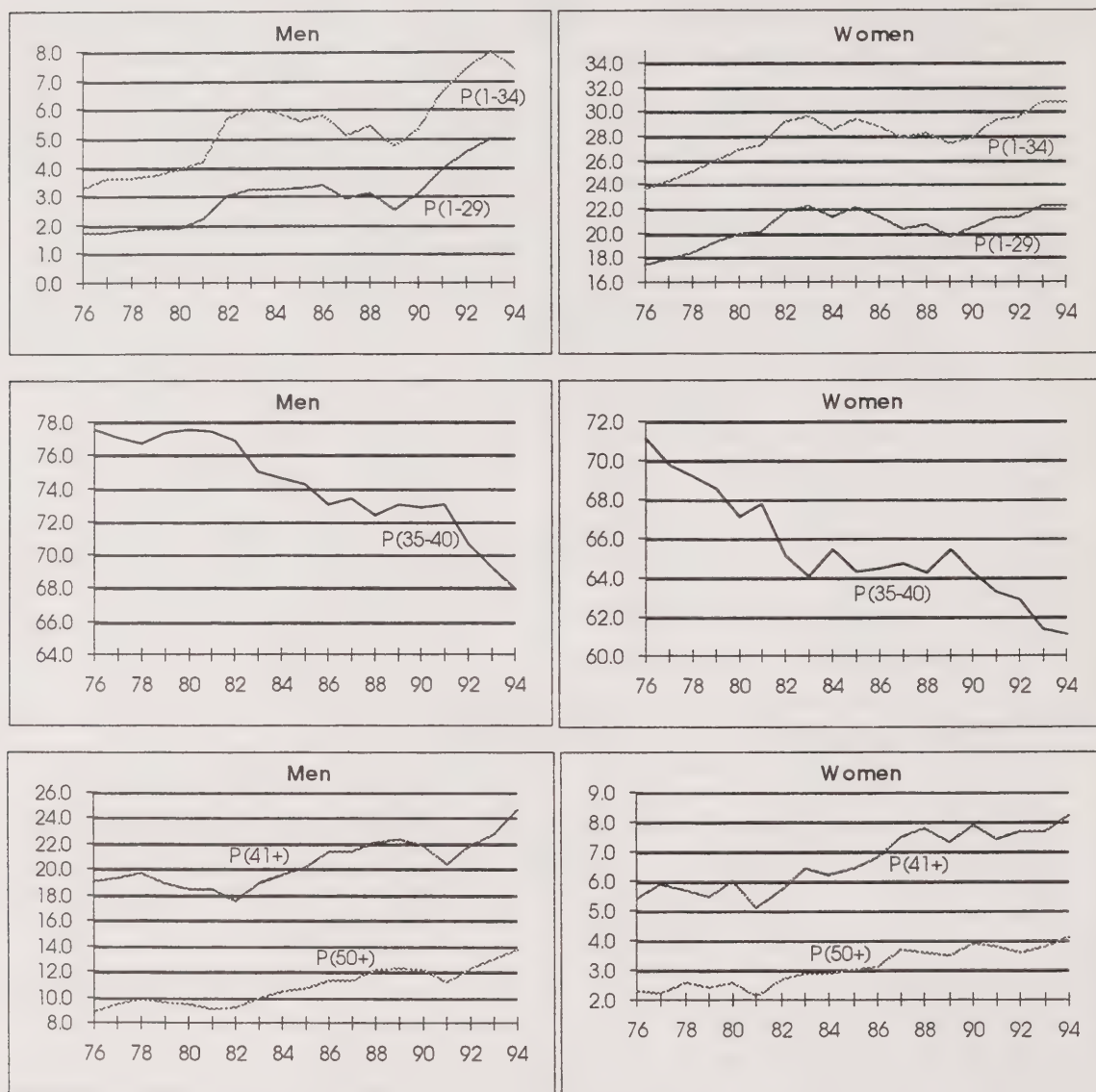


\* The numbers refer to the bottom, middle and top quintile of the distribution of hourly wages.

Source : Survey of Work History of 1981, Survey of Union Membership of 1984 and Labour Market Activity Surveys of 1986-1990.

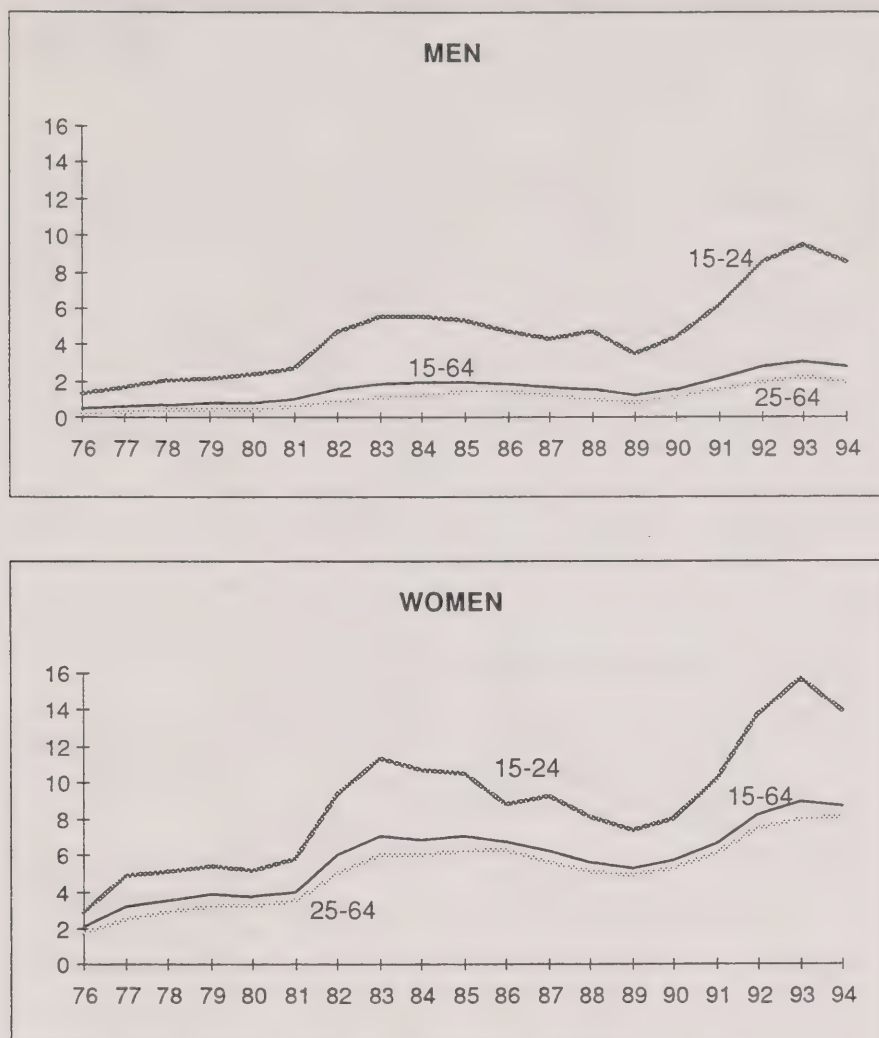


**Figure 4: Percentage of employees working between x and y hours per week in the main job, [P(x-y)], 1976-1994**



**Source : Labour Force Survey.**

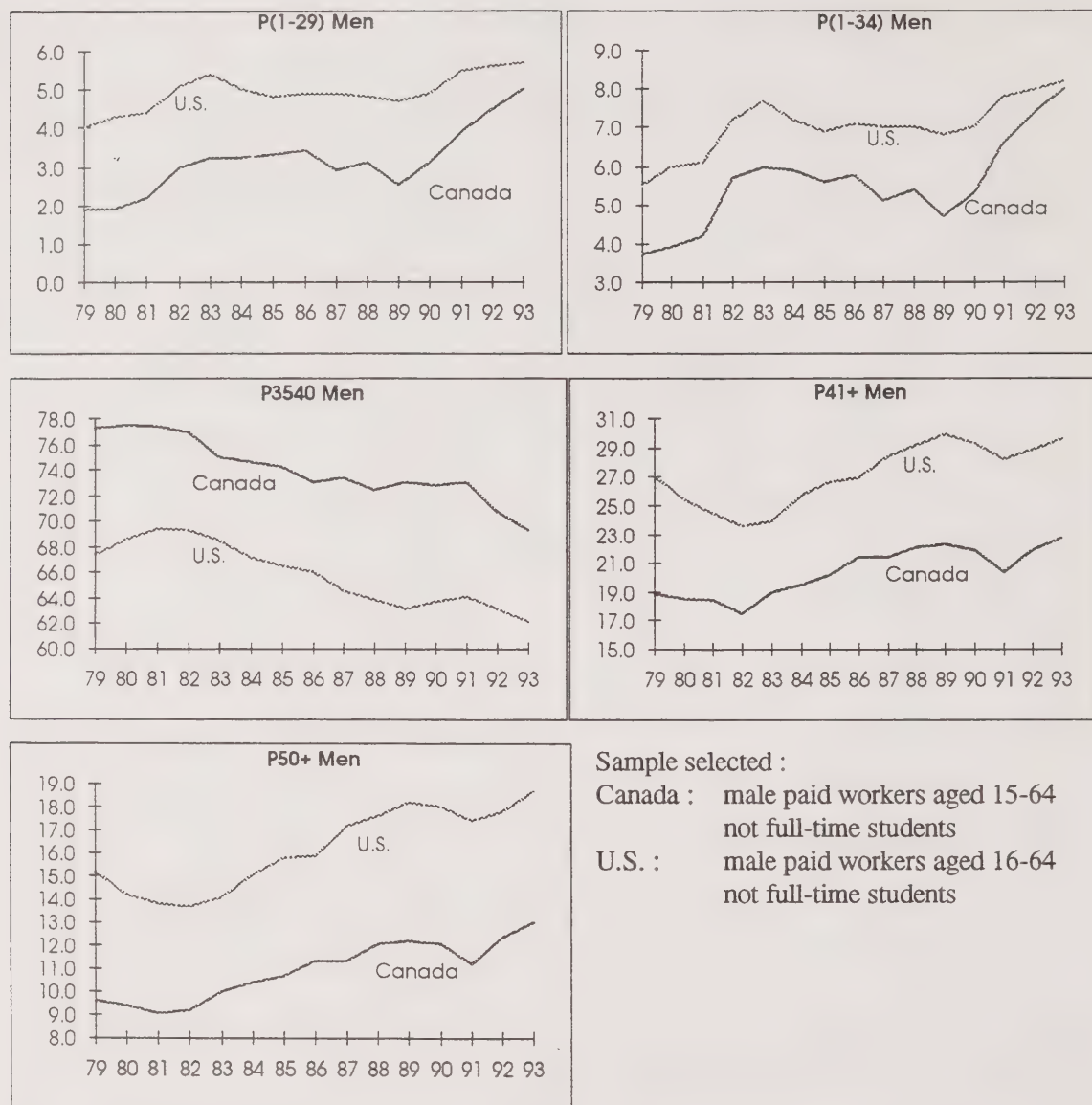
Figure 5: Percentage of employees involuntarily employed part-time, 1976-1994



\* The numbers represent the fraction of employees who worked less than 30 hours per week (total usual hours) because they could only find part-time work.

Source: Labour Force Survey

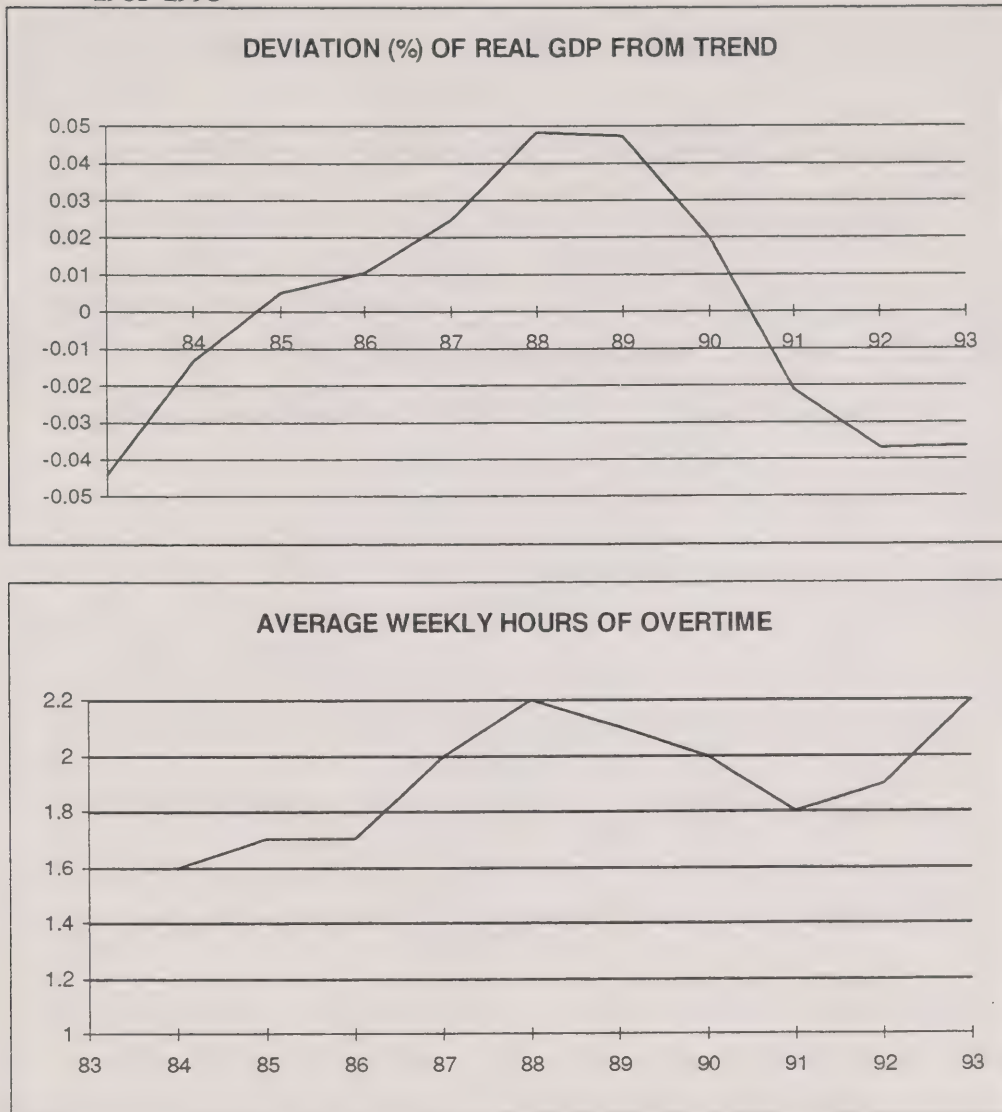
**Figure 6: Percentage of male employees working between x and y hours per week in the main job,  $P(x-y)$ , Canada and the United States, 1979-1993**



Source : Canada : Labour Force Survey. United States : Current Population Survey



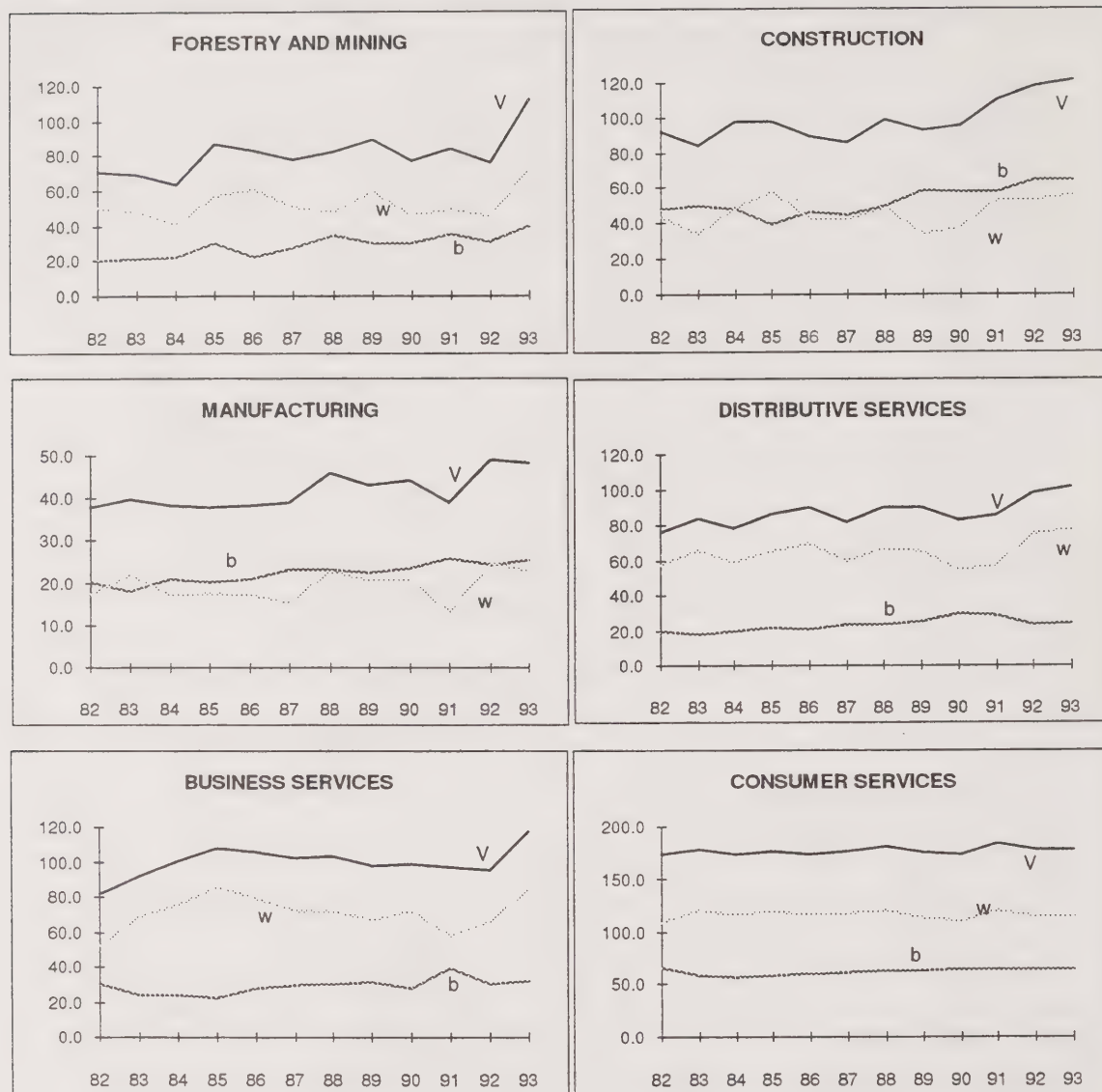
**Figure 7: Percentage deviation of real GDP from its trend and average weekly hours of overtime of hourly-paid workers employed in the manufacturing sector, 1983-1993**



\* Deviation of GDP from its trend is calculated over the period 1961 to 1993.

Source : National Accounts and Survey of Employment, Payroll and Hours.

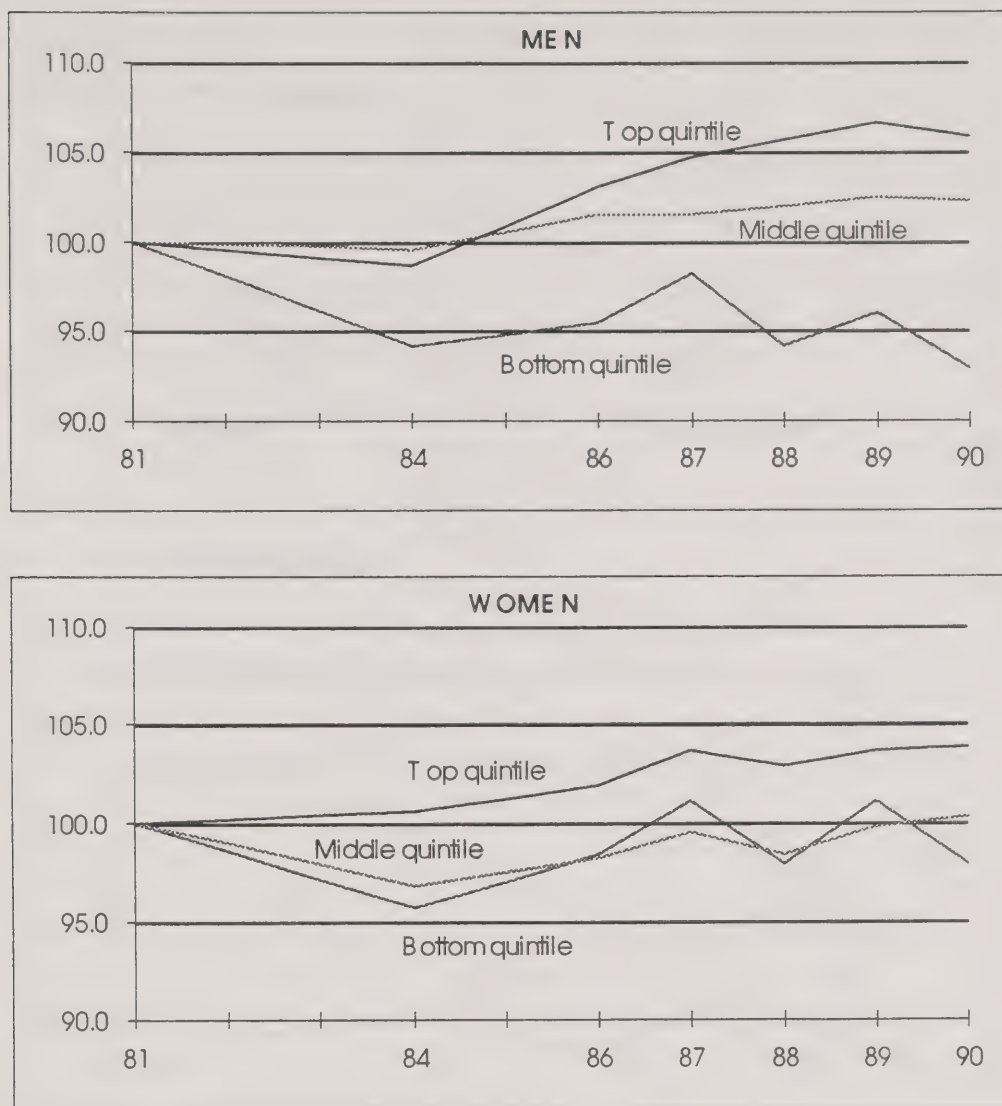
**Figure 8: Variance of weekly hours of work between establishments and within establishments, 1982-93**



V = variance of weekly hours across workers; b = variance of weekly hours between establishments; w = variance of weekly hours within establishments.

Source : Labour Force Survey and Survey of Employment, Payroll and Hours.

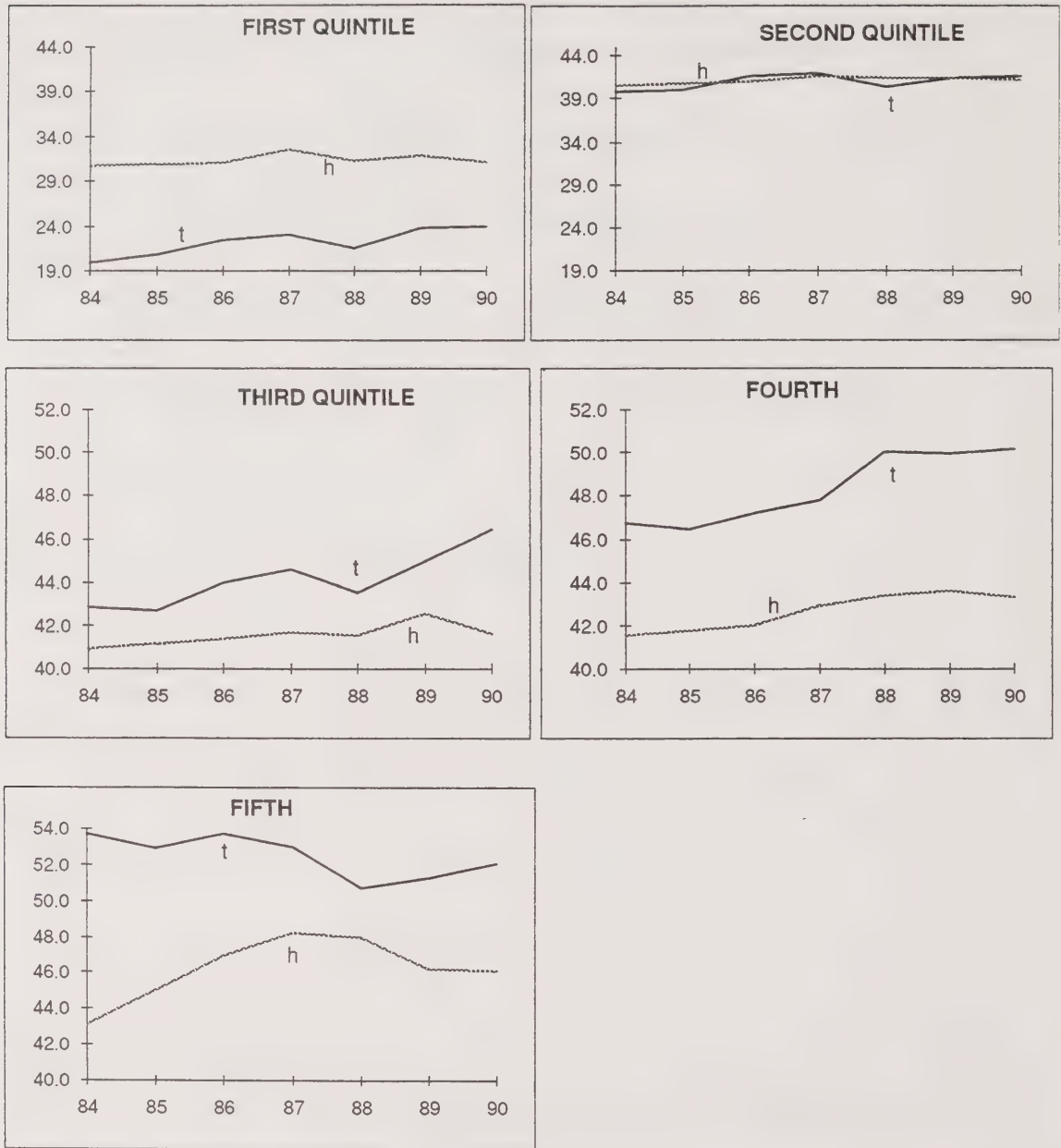
**Figure 9: Average weekly hours worked at the bottom, middle and top quintile, 1981-90, (1981 : 100)**



**Source :** Survey of Work History of 1981, Survey of Union Membership of 1984 and Labour Market Activity Surveys of 1986-1990.



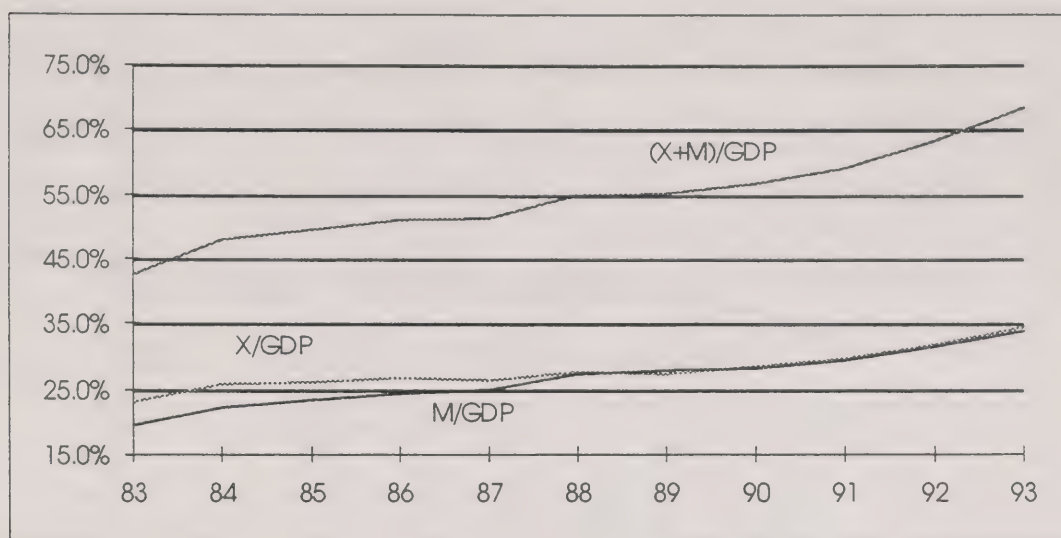
**Figure 10: Effective marginal tax rates and average weekly hours of work by quintile, Ontario male employees, 1984-90**



t = effective marginal tax rates (in percent); h = average weekly hours of work in the main job

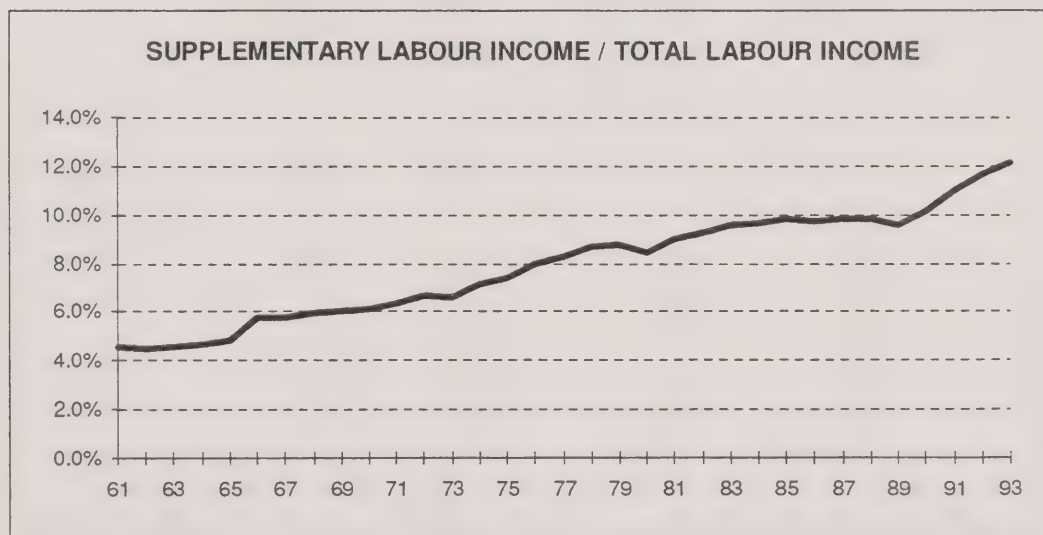
**Source :** Social Policy Simulation Database and Model, Survey of Union Membership of 1984 and Labour Market Activity Surveys of 1986-1990.

**Figure 11: Ratio of real exports and real imports to GDP at factor cost, 1983-1993**



Source : Bank of Canada Review

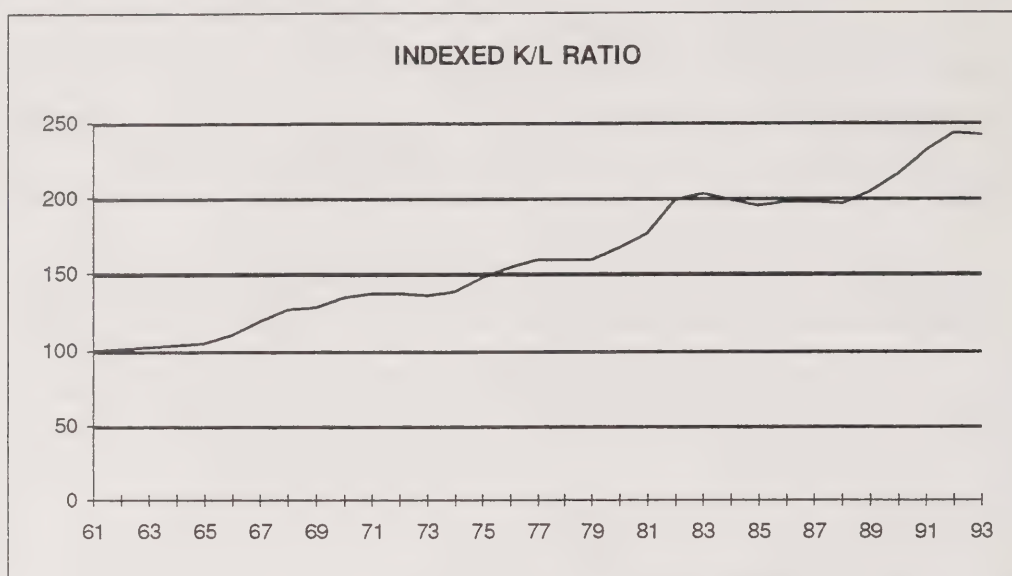
**Figure 12: Ratio of supplementary labour income to total labour income, 1961-1993**



\* Supplementary labour income includes employers' contributions for : 1) C/QPP, 2) UI, 3) Workers' Compensation, 4) private pension plans and 5) welfare (including Quebec and Ontario's payroll tax). Total labour income is the sum of wages and salaries plus supplementary labour income.

Source : Labour Division, Statistics Canada.

**Figure 13: Indexed capital/labour ratio, business sector, 1961-1993**



\* Labour is measured in terms of person-hours.

**Source :Input-Output Division, Statistics Canada.**



## Appendix 1

In this appendix, we deal with two issues. First, we show that hourly wage dispersion within groups is higher in the Survey of Work History of 1981 than during all subsequent years. Following Juhn, Murphy and Pierce (1993), we first regress the natural logarithm of hourly wages on a vector of regressors defined in Table A1. We then calculate the standard deviation of regression residuals as well as the distance between various percentiles of the regression residuals. The results provide estimates of hourly wage inequality within groups defined jointly in terms of age, education, industry and union status, among other things. They are presented in Table A1.

**Table A1: Inequality Measures Based on Regression Residuals<sup>1</sup>.**

	1981	1984	1986	1987	1988
<b>Men</b>					
Standard deviation	0.44	0.38	0.41	0.40	0.39
Percentile differential :					
90-10	1.01	0.86	0.90	0.89	0.90
90-50	0.45	0.41	0.44	0.44	0.44
50-10	0.56	0.45	0.46	0.45	0.46
75-25	0.51	0.44	0.45	0.44	0.46
75-50	0.24	0.21	0.23	0.22	0.23
50-25	0.27	0.23	0.22	0.22	0.23
Observations	19,131	17,084	18,930	22,288	18,587
<b>Women</b>					
Standard deviation	0.43	0.37	0.40	0.39	0.39
Percentile differential :					
90-10	0.92	0.81	0.87	0.85	0.87
90-50	0.47	0.41	0.45	0.43	0.45
50-10	0.45	0.40	0.42	0.42	0.42
75-25	0.45	0.41	0.42	0.41	0.44
75-50	0.22	0.21	0.22	0.21	0.23
50-25	0.23	0.20	0.20	0.20	0.21
Observations	14,629	14,556	16,063	19,181	16,124

1. Results based on a regression of the natural logarithm of hourly wages on the following vector of regressors : 1) one dummy for marital status, 2) four age dummies, 3) four education dummies, 4) sixteen interaction terms between age and education, 5) seven industry dummies, 6) one dummy for union status, 7) one dummy for full-time/part-time job and 8) four region dummies.

Source : Survey of Work History of 1981, Survey of Union Membership of 1984 and Labour Market Activity Surveys of 1986 to 1988.

Second, we present evidence from the Survey of Consumer Finances which shows that, since the second half of the eighties, highly paid workers have worked longer workweeks than they used to at the end of the seventies.

To derive a measure of hourly wages from the Survey of Consumer Finances, we divide annual wages and salaries at time  $t$  by the number of weeks worked at time  $t$  and the number of hours usually worked per week at time  $t+1$ . Since Kuhn and Robb (1994) have shown that, due to reporting errors in either weeks worked or annual wages and salaries, workers in the top decile of the **hourly** wage distribution have unexpectedly : 1) low weeks worked, 2) high weeks of unemployment and, 3) high weeks of non-participation in the labour force, we exclude the top 10% of the hourly wage distribution.

We then calculate mean weekly hours at the bottom, middle and top quintile of the distribution of **weekly** earnings of the remaining sample. Since the Survey of Work History of 1981 and the Labour Market Activity Survey report the biggest increase in weekly hours among men in the top quintile, we restrict our attention to male workers. The results from the Survey of Consumer Finances are presented for the years 1977, 1979, 1981, 1986, 1988, 1991 and 1993. To be clear, numbers shown for, say, 1977, result from annual wages and salaries earned in 1977, weeks worked in 1977 and hours usually worked per week in April 1978 (i.e. at the time the SCF interview was conducted). The results are compared to those from the Survey of Work History of 1981 and the Labour Market Activity Surveys of 1986 and 1988. They are presented in Table A2.

**Table A2: Mean Weekly Hours at the Bottom, Middle and Top Quintile of the Distribution of Weekly Earnings, Male Workers : Comparing SWH-LMAS and SCF Data<sup>1</sup>.**

	1977	1979	1981	1986	1988	1991	1993
<b>I. SWH 1981 and LMAS</b>							
Bottom quintile	-	-	32.3	30.5	30.2	-	-
Middle quintile	-	-	41.2	41.5	41.7	-	-
Top quintile	-	-	43.6	44.6	46.1	-	-
<b>II. Survey of Consumer Finances<sup>2</sup></b>							
Bottom quintile	39.6	38.9	37.9	37.7	36.3	34.7	33.8
Middle quintile	41.8	41.6	41.4	42.0	42.2	41.9	42.5
Top quintile	43.1	43.7	43.3	44.7	44.9	44.9	45.3

1. For all data sets, the top decile of the hourly wage distribution is excluded.

2. The sample consists of male workers with positive annual wages and weekly hours of work.

While the two panels of Table A2 exhibit some differences for weekly hours of work in the bottom quintile in a given year, they show the same trends. Between 1986 and 1993, male workers in the top quintile (of the distribution of weekly earnings) of the truncated sample worked between 44.7 and 45.3 hours per week, compared to 43.1 - 43.7 hours between 1977 and 1981. This is consistent with the increase in the length of the workweek (from 43.6 to 46.1 hours) observed between 1981 and 1988 with the Survey of Work History and the Labour Market Activity Survey. Furthermore, all data sets suggest that hours worked in the bottom quintile have declined in the eighties.



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